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In This Issue—S. A. E. Production Meeting and Highway Education Conference.

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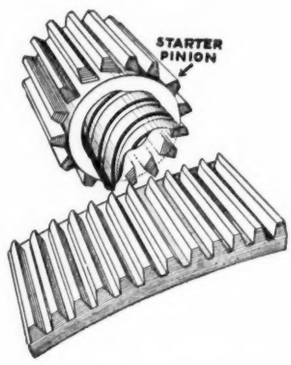


AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XLVII NEW YORK—THURSDAY, NOVEMBER 2, 1922 No. 18

Two Meetings Full of Food for Thought

S. A. E. Production Session—

PRODUCTION men turned out in full force for the first S. A. E. Production Meeting. Five hundred of them came to the sessions held in Detroit Oct. 26 and 27.

They arrived early, listened intently to the papers, and discussed with vigor and interest every topic that was brought up.

The pages immediately following tell the story of this big gathering. They outline the present trend in automotive production and show what is being done to solve the many problems faced in every factory.

The story will bring to those not present a clear picture of the ideas and tendencies developed at this important meeting and will serve to visualize clearly the outstanding features in the minds of those who did attend the sessions.

Highway Education Conference—

UNQUESTIONABLY the most important convention of its kind ever held in the United States was the second national conference on education for highway engineering and highway transport at Washington last Thursday, Friday and Saturday.

All the leading colleges and universities of this country and a dozen foreign nations were represented. It was evident that not only America but other lands as well are alive at last to the fact that they must constantly extend their highway systems if they are to progress. This means a steadily widening market for motor vehicles and automotive products.

Educators, engineers and the spokesmen of the industry are approaching agreement on the main features of the program which must be carried through in reference to education, construction and finance. Huge sums will be available annually and they must be expended wisely if taxpayers as a whole are to profit as they should.

Good roads are the instruments which must be used in breaking down the barriers between the city and the country. If America is to attain its full destiny, social, political and industrial advantages must be made equally available to all.

In this work the automotive industry has a deeper direct interest than any other. Up to this time only a few of its leaders seem to have realized this fact.

AUTOMOTIVE INDUSTRIES believes that in the Washington conference there was something of deep and vital interest to every man in the industry. For that reason it is devoting 18 pages of the present issue to a complete report of the proceedings. The account begins on page 874 and ends on page 891.

Probably never before in a single issue has any American publication given so much space to a discussion of highway and highway transport education with their attendant problems of construction and finance.

New Men Voice New Ideas at First S. A. E. Production Meeting

Engineers discuss how to cut out red tape, reduce overhead costs, and prevent waste. Gear production methods examined. Group-bonus system of wage payments explained. Five hundred attend highly successful session and evidence keen interest in topics on program.

By Norman G. Shidle

CUT out the red tape. Reduce overhead costs in every phase of production work. Study gear manufacturing problems carefully and conduct intensive research. Always take into account the desires of the individual worker when considering wage systems. Exchange ideas about production methods and practices and realize the full benefits of co-operation. These were some of the chief points emphasized by automotive production men at the First Annual Production Meeting of the Society of Automotive Engineers held in Detroit, Oct. 26 and 27.

Production engineers came out in full for this session, the first S. A. E. gathering devoted entirely to production problems. Nearly 400 members and guests had registered before noon of the first day, and the total attendance for the meeting was about 500. Both technical sessions were attended by more than 400 and practically everybody stayed throughout the entire sessions, despite the fact that the Friday morning meeting was not over until well after 1 p. m.

E. Karl Wennerlund, whose paper on the group-bonus system was widely discussed

The large attendance and the very lively interest in the papers and discussions were both as gratifying as they had been unexpected. The marked success of the meeting was due in large part to the selection of topics for papers, the excellent handling of the meetings by the chairmen and the efficient organization and operation of the entire program. The sessions provided not only interest for those who attended, but also a very great deal of practical help and actual information.

Papers and discussion throughout the meeting reflected the intense interest of automotive production men in the reduction of overhead costs. While mechanical production methods were discussed to some extent, the underlying theme of most of the thought was the necessity for cutting out waste effort, waste material and waste supervision.

Group-Bonus System Simplifies Records

E. KARL WENNERLUND, General Motors Corporation, giving the opening paper of the meeting on the Group-Bonus Method of Wage Payment, for example, stated that this method of wage payment has been adopted primarily because it simplifies factory records and detail work very materially. He pointed out that most incentive wage systems, such as straight piece work, require a vast amount of "paper" system; that a time has come when all "paper" systems must be carefully weighed to see whether or not the efficiency gained by them is greater than the detail work necessary to keep them in operation.

F. A. Mance of Studebaker expressed the same general idea in connection with another phase of the production problem. Mance showed how a plan of budgeting tool and supply disbursements to various fac-

tory departments resulted in a 71 per cent decrease in the cost of renewal of perishable tools, while the work of operating the budgeting system, once under way, was no more than under the old system.

R. K. Mitchell of Maxwell and A. J. Baker of Willys-Overland, showed that overhead cost should be a major consideration in the purchase of machine tools. They pointed out the fact that many special purpose tools bought to decrease the time of production, have been uneconomical because other important items of expense in their purchase and operation had not been considered.

Cost Factors Are Considered

NEARLY every speaker at some time touched upon one or another of these cost factors surrounding production and emphasized their importance in connection with actual production work. This fact does not evidence any lack of appreciation of the mechanical problems of production. It does reflect, however, the type of problem which is occupying the chief attention of production men to-day. They are finding it necessary to analyze and study such matters as overhead costs, wage-systems, production records, and waste more intensely than ever before. They are finding essential a solution of what might be called "surrounding problems" if their mechanical production methods are to produce the real efficiency for which they were designed.

A trend toward close study and intensive research in production problems also is evidenced by the ideas developed at this meeting. Careful study of production methods has been going on, of course, for many years, but a tendency toward actual research, dealing with very minute refinements, is in evidence in addition to the general type of study that has been common.

K. L. Herrmann of the Studebaker Corporation, for example, in his paper on "Production Errors in Gears," gave a detailed account of a series of research investigations on this subject that has been carried on by his company. This paper, printed on later pages of this issue, brought out considerable discussion, representatives of many important companies exhibiting a keen interest in the research methods and results discussed in Herrmann's paper. It seems evident from the discussion

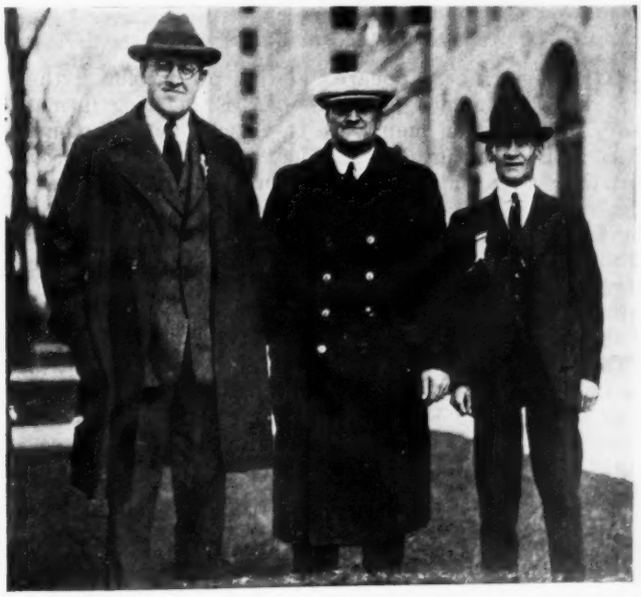
K. L. Herrmann, Studebaker Corp., gave the machine tool builders something to think about, in addition to presenting much new information about production errors in gears

that further investigations along this particular line will be carried on by other companies and that the topic will come in for further illumination at future production meetings.

Illustrates Gear Imperfections

HERRMANN reached the heart of the present day gear production problem. He clearly illustrated the imperfections of present day gears made with the best available production tools. His paper, in part, was an appeal to the gear-making machine men to give better production tools. He illustrated his talk with graphic views of magnified gear teeth and made it clear that better manufacturing methods would result from recent

Continental Motors was represented by: L. P. Kolb, W. H. Seeger, F. A. Hammer



Among those present from Cadillac were: Harry Ford, D. G. Clemmer, V. W. Myers

They Helped to Make the Meeting Successful

A. B. C. Hardy, president of the Olds Motor Works, spoke at the Production Dinner

B. B. Bachman, president of the S. A. E., presided at the Friday technical session

H. W. Alden, president-elect of the S. A. E., presided at the Thursday technical session

research, so that we may look forward to quieter transmissions in the future.

The paper prepared by H. J. Crain and J. Brodie of the Packard Company further illustrated this trend toward detailed research. It dealt chiefly with the results of investigations carried on at Packard to determine the cause of gear noise, together with a discussion of remedies.

Further indications of this trend appeared in the description given by the Franklin representative of the experiments Franklin has been conducting to develop a method of producing drive-shafts by the hot swaging process; in the brief description given by the Ford representative of a new machine, pneumatically operated, to pack sand in molds in foundry work; and in other minor developments of greater or less importance.

Many New Faces

MORE new faces appeared at this production gathering than at any previous S. A. E. meeting in many years. Production men were there who never attended an S. A. E. meeting before. They came out in full force and they apparently came for business. There was a great deal of interested and spirited discussion despite the fact that this was the first special meeting for production men and despite the fact that few of the papers were printed in advance. The chairman was forced to shut off discussion because of lack of time after most of the papers.

Technical sessions were held in the morning, while the two afternoons were devoted to factory visits. Everybody went to the Ford River Rouge plant on Thursday afternoon, while on Friday the visitors were divided between Packard, Cadillac and Dodge.

Pierre S. du Pont, chairman of the board of General Motors Corporation, and A. B. C. Hardy, president of the Olds Motor Co., were the chief speakers at the production dinner, which was held Thursday evening at the Hotel Statler. Du Pont spoke briefly, emphasizing the importance of co-operation in solving the problems of the industry and pointing out that there are many common problems to be met. "If we work together in this industry," DuPont said, "its problems will be easily solved; if we are not fearful, they will be solved that much easier."

Production Man's Scope of Knowledge

HARDY outlined the wide scope of knowledge necessary in the successful production man. Touching upon labor and wage systems, he pointed out that "the production man must know in a general way about day work, piece work and group bonus systems as he is the first man that we have to sell any new rating system to and he in turn must help sell it to his department heads and they in turn to their employees. And he must know in a general way the results to be expected from each of these systems."

B. B. Bachman, president of the Society of Automotive Engineers, presiding at the banquet, emphasized the value of unity of interest and co-operation in activity among the various members of the society, whether they be design or production engineers. He voiced his enthusiasm for special meetings dealing with specific phases of automotive work, such as the production meeting, but pointed out the necessity of every engineer keeping his viewpoint broad and taking an active interest in all of the society activities.

Kettering Speaks Extemporaneously

SPEAKING extemporaneously, C. F. Kettering advocated calling in the production man for consultation before a new design is made. He said that the cost accountant should also be consulted, that the fundamental economies of the car and its use may be considered at the inception of the design. Harold H. Emmons acted as toastmaster.

Col. H. W. Alden, president-elect of the Society of Automotive Engineers, presided at the first technical session, while B. B. Bachman was in the chair on the second day.

Group-Bonus Plan Simplifies Factory Records

Progressive system of manufacture favorable to wage-payment plan described. Individual incentive retained.

THE group bonus system of wage payment is valued chiefly because it simplifies factory detail very greatly, and, at the same time, increases all the incentive values of the individual bonus method of payment. Bonus is paid to each worker in a group in proportion to the production of the group, a standard time having been previously determined for the series of operations performed by each group.

In addition to simplifying factory records, the group bonus system tends to speed up production, and thus lower unit costs, because it gives each man a personal interest in the efficiency of every other man in his group. The elimination of one man from the group, for instance, without a lowering of production, means more bonus for each worker in the group. Thus each worker desires to get the unit produced with the smallest force in the shortest time.

E. Karl Wennerlund brought out these points in his paper on "The Group-Bonus Wage-Incentive Plan" and included a detailed description of how such a plan can be successfully operated. "The group plan is primarily applicable to repetitive work arranged in progressive production lines of sequence operations," Wennerlund said, "but it is also applicable to non-progressive operations where the individual interest can be centered on definite results per man-hour of labor. Like any other wage incentive plan, it has for its main object the speeding up of the production rate per employee; that is, intensive production.

"It is being used," he continued, "because it simplifies the factory detail where a high rate of production is desired on repetitive work, and where a wage incentive is employed as a means of obtaining intensive production. Its application has gained favor among factory executives because it speeds up production as compared with the individual plan on the same work, ties up less material in process, and minimizes clerical detail in the factory."

THE necessity for eliminating red tape and all except absolutely necessary records in factory routine is well illustrated by Wennerlund's statements about the group-bonus system of wage payments. Throughout his paper he shows how records can be cut down, how material can be kept moving, and how supervisory checking work can be reduced to a minimum. These points are specially interesting to automotive manufacturers in whose plants large scale production has created a large number of supervisory records which sometimes tend to multiply detail work without a corresponding increase in efficiency.

Wennerlund began his talk by saying that the object of this group-bonus system of wage payments is the same as that of every other wage-incentive plan, namely:

(1) To stimulate the worker to a greater effort than is generally obtained on a straight day's-work basis
(2) To reward him somewhat in proportion to his effort
(3) The gaining of other advantages such as the attention given to conditions that curtail production, more uniform labor costs and the elimination of inefficient employees

He then discussed this particular plan in detail, saying in part:

NEARLY all industries engaged in repetitive work, with very few exceptions, are on an incentive basis. Until recently, the plan followed has been generally of the type known as the individual-effort plan, with either straight piece-rates or some form of premium or bonus based on time measurements. Grouping of employees was not often resorted to, except for such operations as made it impracticable to keep track of the output from individuals. The application of grouping of employees throughout an entire factory organization, wherever work is measurable, is rather a new development in industry.

In automobile factories and most accessory plants, the character of product is such as to make parts move progressively from one operation to the next to a very great extent.

It must be taken into account that an individual-effort system of payment to workers entails considerable routine expense. The earliest method, after rates had been set, was for each worker to make out a report at the end of the day stating how many pieces he had completed under each operation; or a shop checker came for this information and inserted the quantities on a prepared form. A sys-

R. K. Jack,
Chief Engineer,
Olds Motor Works

J. M. Watson, Metallurgical Engineer, Hupp Motor Car Corp.

G. E. Goddard, Asst. Chief Engineer, Dodge Bros.

E. Planche, Chief Engineer, Dort Motor Car Co.

tematic check on quantities after each operation was, of course, impracticable with large-volume production unless some special means were provided; so, there was much opportunity for collusion between shop checkers and workers and there is no doubt that many took advantage, particularly on parallel operations, of the management's inability to obtain an actual check.

Well-organized factories, operating under the individual-effort plan in recent years, have developed various methods for obtaining physical checks on quantities after each operation.

These methods are all good in theory. No doubt they pay their way when compared with having no definite check, and they may be entirely practicable in small shops or for certain classes of work, but let us consider the modern automobile factory. The lot method not only ties up a large inventory of parts in process, but to check off and extend thousands of job tickets, daily, also involves a great expense. One such factory had in excess of 25,000 job tickets for each working day, each one of which had to be carefully audited as to quantity and rate, extended for total and then credited to the account of the employee.

IT was the desire to simplify the factory routine, and to escape from this mass of detail management without sacrificing the principles of quantity checks, that prompted the development of the group-bonus plan. Certain fundamental principles of industry had to be recognized and taken into account. The most important of these are

(1) Under any incentive plan, the worker must continue to maintain an individual interest in the rate of production
(2) He should be guaranteed a satisfactory hourly wage
(3) He should be paid for all time saved instead of for only a part of it
(4) He should be able to compute his own earnings, accurately and quickly

Under the group plan, it would not make much difference in theory whether a fixed group-price were established or some form of bonus or premium payment were used. Our past experience, however, indicated that it was preferable to set standards of output in *time* rather than in money value.

In regard to a uniform base-rate for all members of a group and their division of the earnings purely on an hourly basis, it is obvious that this method would prove unsatisfactory as a general policy; because, even in the same group, some operations may require more skill than others. Then there is the added consideration that employees who have been long in the service should be on a higher wage plane than beginners. The standard-time bonus-table as adopted offers every facility for differentiating between base-rates and permits a flexible system to suit the varying labor and factory conditions.

TABLE A—BONUS TABLE FOR PRODUCTIVE WORKERS

Percentage Efficiency	Bonus	Percentage Efficiency	Bonus	Percentage Efficiency	Bonus
75	1.0	117	40.4	159	90.8
76	1.6	118	41.6	160	92.0
77	2.2	119	42.8	161	93.2
78	2.8	120	44.0	162	94.4
79	3.4	121	45.2	163	95.6
80	4.0	122	46.4	164	96.8
81	4.6	123	47.6	165	98.0
82	5.2	124	48.8	166	99.2
83	5.8	125	50.0	167	100.4
84	6.4	126	51.2	168	101.6
85	7.0	127	52.4	169	102.8
86	7.6	128	53.6	170	104.0
87	8.2	129	54.8	171	105.2
88	8.8	130	56.0	172	106.4
89	9.4	131	57.2	173	107.6
90	10.0	132	58.4	174	108.8
91	11.0	133	59.6	175	110.0
92	12.0	134	60.8	176	111.2
93	13.0	135	62.0	177	112.4
94	14.0	136	63.2	178	113.6
95	15.0	137	64.4	179	114.8
96	16.0	138	65.6	180	116.0
97	17.0	139	66.8	181	117.2
98	18.0	140	68.0	182	118.4
99	19.0	141	69.2	183	119 6
100	20.0	142	70.4	184	120.8
101	21.2	143	71.6	185	122.0
102	22.4	144	72.8	186	123.2
103	23.6	145	74.0	187	124.4
104	24.8	146	75.2	188	125.6
105	26.0	147	76.4	189	126.8
106	27.2	148	77.6	190	128.0
107	28.4	149	78.8	191	129.2
108	29.6	150	80.0	192	130.4
109	30.8	151	81.2	193	131.6
110	32.0	152	82.4	194	132.8
111	33.2	153	83.6	195	134.0
112	34.4	154	84.8	196	135.2
113	35.6	155	86.0	197	136.4
114	36.8	156	87.2	198	137.6
115	38.0	157	88.4	199	138.8
116	39.2	158	89.6	200	140.0

TABLE A is based on the theory that a bonus incentive of 20 per cent should be paid to a worker, in addition to his hourly base-rate, for attaining an efficiency of production of 100 per cent; and that, for a greater speed of production, he should be paid for all time saved. The table is constructed so as to give a gradually disappearing percentage of bonus, as efficiency of production falls below the standard. During the past eleven years, this bonus table has been used extensively in our plants; first as an individual-effort incentive and, in later years, as a group incentive.

The standard time of a single operation is determined by time-study. For this purpose the decimal stop-watch is used. By standard time is meant the time required by the average competent workman, taken repeatedly, over an extended period, eliminating lost and waste time. It will contain allowances for legitimate tool-changes and for rest and delay to the worker. It is our practice, for convenience, to designate standard time in decimal hours rather than in minutes. For this purpose a conversion table has been devised, because the detail time-study is observed in decimal minutes, while the standard time is converted into hours.

GROUP standard-time is obtained by totalling the individual standard-times for all operations embraced by a group. It thus always appears as one-man hours, independently of how many workers may subsequently be assigned to a designated group. All detail operation standard-times and the group standards are listed on a shop routing for ready reference.

To obtain a clear idea of the application of group standard-time and its use as a basis for a wage-incentive plan, let us consider a single production line manufacturing and assembling pistons in an automobile-engine plant. This unit has its operations arranged in sequence, in what is known as a progressive line of manufacture. It starts with the rough-machining of the casting and ends with the finished product with piston-rings inserted. The production line includes both machine and bench-assembly operations. Parts move without a break from one operation to the next in a steady flow. Some operations may be done by a single workman; others may have several workers in parallel, depending on the volume of production and with what detail it is practicable to subdivide operations.

It is proposed to keep no check on quantities passing intermediate operations or on those completed by individual workers on operations in parallel but to give credit for finished pistons passing final inspection. This particular production line may be located in a department also producing connecting-rods or any other line of manufacture. Such a line embraces a production unit of the factory, and is technically known under the group plan as a *division*. Its workers are primarily interested in the production of pistons; they know little or nothing about condi-

A. F. Knobloch

T. J. Litle, Jr., Lincoln Motor Co.

F. E. Watts, Chief Engineer, Hupp Motor Car Corp.

W. R. Strickland

tions on the connecting-rod line and should not be grouped with it.

A STUDY of the piston-line division indicates that there are two distinct classes of machine work, besides bench operations. The machine operations are lathe turning and grinding. There are thus three major operations, and the workers group themselves naturally into these three classes of work. It is thus seen that a division may consist of any number of distinct groups. They are bound together because they receive credit only for the finished product at the end of the division, while they are distinct and independent so far as efficiency measurement and bonus reward are concerned. A group is debited with the actual man-hours of the workers in the group and is credited with the group standard-hours multiplied by the number of pieces passing the division. That is, the quantity count is not taken at the group operations but at the end of the division of work. The ratio between standard hours and actual hours constitutes the efficiency measurement for which a bonus percentage is paid. For convenience, the entire pay-period of 1 or 2 weeks is run on a cumulative basis, and bonus is computed on the average efficiency attained for the period. Obviously, for a given product, the fewer actual man-hours there are in a group, the higher the efficiency of production will be and the greater the per cent of bonus earnings. The incentive is, therefore, to obtain a high rate of production per man per hour consistent with good quality of product.

Each member of a group receives the same percentage of bonus at the end of the pay period; but it is computed on his wage earned while assigned to the group; and the total amount earned by each worker will, therefore, depend on his hourly base-rate and number of hours worked. No job tickets are used. A shop timekeeper will handle from 300 to as high as 600 group workers. A list of employees is tabulated daily for each group, and elapsed time is taken at the end of the day from the entrance time-clock. If a worker is transferred out of or into a group, a transfer slip noting the time is recorded by the timekeeper and the elapsed hours are charged accordingly. Standard-hours credit is obtained from the finished inspection reports of quantities, multiplied by the group standard-time.

A GROUP may produce various parts having different time-standards, and therefore different direct-labor costs and, since we use no individual elapsed-time job-tickets, labor costs are computed from the group cost per standard-hour. For given base-rates, the labor cost will be constant per standard-hour and per piece for all efficiencies above 100 per cent. If the average efficiency falls to 90 per cent, the labor cost will increase less than 2 per cent.

In the above discussion, we have assumed that the production line has its operations arranged in sequence. Such lines are, of course, ideal for the grouping of workers. But in the class of factories we are considering, there may be anywhere from 5 to 40 per cent of the direct-labor operations that cannot be arranged progressively. Such departments usually consist of miscellaneous small machines, automatics, grinders, or minor bench operations. However, it has been our practice up to the present to group such departments according to similar operations, being careful to retain the personal interest of the worker in the group production. Credit is given only for finished parts as they leave the department. So far, such grouping has been entirely successful. If there were any special departments of work in such factories that could not be grouped to advantage, there would be no objection to leaving them on an individual-incentive basis or even on a straight day-rate basis.

INDIRECT labor has been grouped extensively wherever a "community of interest" can be maintained between workers. They must have a common interest in the results of their own efforts. Storeroom labor, unloading materials from car, boxing and loading automobiles for shipment and similar classes of work where the effort is measurable, have been grouped with very good results.

To have a group plan remain in successful operation over an indefinite period. it is necessary to maintain the interest of the individual worker in the group effort. It

TABLE B—WAGE TABLE FOR PRODUCTIVE WORKERS; COMPUTED FROM TABLE A

Employe's Hourly Base Rate	Hourly Earnings at 85 to 130 Per Cent Efficiency									
	85	90	95	100	105	110	115	120	125	130
$0.25	$0.268	$0.275	$0.288	$0.300	$0.315	$0.330	$0.345	$0.360	$0.375	$0.390
0.26	0.278	0.286	0.299	0.312	0.328	0.343	0.359	0.374	0.390	0.406
0.28	0.300	0.308	0.322	0.336	0.353	0.370	0.386	0.403	0.420	0.437
0.30	0.321	0.330	0.345	0.360	0.378	0.396	0.414	0.432	0.450	0.468
0.32	0.342	0.352	0.368	0.384	0.403	0.422	0.442	0.461	0.480	0.499
0.34	0.364	0.374	0.391	0.408	0.428	0.449	0.469	0.490	0.510	0.530
0.35	0.375	0.385	0.403	0.420	0.441	0.462	0.483	0.504	0.525	0.546
0.36	0.385	0.396	0.414	0.432	0.454	0.475	0.497	0.518	0.540	0.562
0.38	0.407	0.418	0.437	0.456	0.479	0.502	0.524	0.547	0.570	0.593
0.40	0.428	0.440	0.460	0.480	0.504	0.528	0.552	0.576	0.600	0.624
0.42	0.449	0.462	0.483	0.504	0.529	0.554	0.580	0.605	0.630	0.655
0.44	0.471	0.484	0.506	0.528	0.554	0.581	0.607	0.634	0.650	0.686
0.45	0.482	0.495	0.518	0.540	0.567	0.594	0.621	0.648	0.675	0.702
0.46	0.492	0.506	0.529	0.552	0.580	0.607	0.635	0.662	0.690	0.718
0.48	0.514	0.528	0.552	0.576	0.605	0.634	0.662	0.691	0.720	0.749
0.50	0.535	0.550	0.575	0.600	0.630	0.660	0.690	0.720	0.750	0.780
0.52	0.556	0.572	0.598	0.624	0.655	0.686	0.718	0.749	0.780	0.811
0.54	0.578	0.594	0.621	0.648	0.680	0.713	0.745	0.778	0.810	0.842
0.55	0.589	0.605	0.633	0.660	0.693	0.726	0.759	0.792	0.825	0.858
0.56	0.599	0.616	0.644	0.672	0.706	0.739	0.773	0.806	0.840	0.874
0.58	0.621	0.638	0.667	0.696	0.731	0.766	0.800	0.835	0.870	0.905
0.60	0.642	0.660	0.690	0.720	0.756	0.792	0.828	0.864	0.900	0.936

must be simple for computation of individual earnings, flexible so as to meet changing factory conditions and easily understood by each group member.

SEVERAL production men described briefly the wage payment system in use in their particular plants, following Wennerlund's presentation of the group-bonus plan. Some felt that other methods of payment were better adapted to their particular conditions, but great interest was evidenced in the possibilities of the system described.

Wennerlund was questioned as to the effect of the group-bonus plan on inspection and replied that only good pieces are accepted and counted as part of the bonus. When a defective piece comes through, a piece which can be used if re-worked, it is simply put through the line as a new piece and is paid for when it passes inspection. Spoiled pieces that have to be scrapped are not paid for and simply are handled as scrap would be handled under any other system.

When a man is discharged during a pay period, he is paid his base rate plus a bonus equal to the average bonus earned by the group during the period up to the time of discharge.

THE groups should be kept small, Wennerlund said in summarizing his answers to questions, confining the bonus application to small groups of workers on similar tasks. He emphasized strongly the necessity for considering the desires and aspirations of the individual worker in installing and operating this group-bonus plan. He showed that upon its ability to provide an easily visible, and readily calculated reward for individual effort rests the success of any such plan.

He said that these few plants who have tried this system and discarded it have not really tried it at all—they have just "monkeyed with it."

SUCH a plan as described rests fundamentally, of course, upon certain factors not included in the foregoing discussion. Accurate and fair time study work is essential, while an honest attempt on the part of the manufacturer to gage individual service value in setting base rates, a reasonable stability of time standards once they have been set, and a sincere attempt to advance the base rate of loyal and capable employees constitute other basic factors. These facts are mentioned here merely as a matter of interest, although the scope of the paper presented was confined more directly to the operation and functioning of the system itself.

Wennerlund did emphasize in his discussion, however, the necessity for avoiding excess "paper" systems, and showed the need for obtaining from any system only those checks and results of which you actually make use. Effort used in getting information which is not actually used is simply waste effort. The fact that the group-bonus plan gets you out of a lot of "paper business" is one of its chief merits.

Reducing Errors in Gear Production

Noisy gears usually result of manufacturing methods. Better machine tools needed. Errors can be checked.

K. L. HERRMANN, Studebaker Corporation, in his paper on some causes of gear-tooth errors and their detections, told of the efforts which manufacturers are making to secure accurate production gears. Production variables, he pointed out, have a much greater influence on gear sounds than the fundamental or mathematical variables, such as pressure angles, steel or tooth-form details.

He also showed, by illustrating the errors in present gear manufacture, that it is necessary to appeal to the designer of the gear for further help.

He described in detail the various kinds of errors found in production gears, with particular reference to the effect of these errors on gear noise, pointing out that it is not sufficient to check gears for spacing error from tooth to tooth. It is very desirable to check the accumulated error of a number of teeth, because a gear may vary 0.001 in. from tooth to tooth. With eight successive teeth each gaining 0.001 in. on the side of the gear and a similar number of teeth that may be losing 0.001 in., a total error of 0.016 in. might be imparted to the driven gears. This paper is printed in full on later pages of this issue.

DEVICES for checking this accumulated error were illustrated and some of the causes were indicated. In discussion the comment was made that in some shops the hobbing machine is used only for roughing. The number of questions asked the author reflected the common character of this gear problem. Some of the queries brought up were:

1. How is silence secured in the foreign four-speed gearbox?
2. What is the limit on spiral angles?
3. What has been done in the last 2 years to improve gear manufacture?
4. What are the possibilities of silent chain for transmission gearsets?
5. What are the possibilities of gear grinding?
6. What are the possibilities of using single point finishing tools or broaches for the final finish of the gear teeth?

R. S. DRUMMOND of the Gear Grinding Machine Co., in answer to the appeal of President Bachman for comment from some of the machine tool manufacturers, stated that he was particularly interested in the mechanism for measuring errors in the gear teeth. He said that engineers have been skeptical as to the possibility of such measurements, although they are really worth while. The consistent use of these instruments will improve gears and, consequently, promote silence, he believes. He also made the statement that there were about fifteen types of mechanical measurement devices as well as the optical types.

In closing the discussion, Herrmann stated that grinding can be resorted to and that very accurate results can be obtained in this way with a high degree of finish,

W. H. Wilson, Motor Wheel Corp.

V. Bendix, Pres. Bendix Eng. Works, and W. A. Chryst, Chief Engineer, Dayton Engineering Laboratories

S. W. Taylor, Maxwell Motor Co.

but that the gear itself, in this case, must first be accurate. Referring to the question as to whether gears can be hobbed as accurately as they can be cut, Herrmann answered "Yes," and added that his reply would be the same if the question had been asked in the opposite way.

As regards foreign practice, he stated that the lapping methods, etc., possible with small production would be impossible on a large commercial scale here. He stated that 45 deg. in spiral angles is common and used by his organization. He said that the silent chain was a great help in securing quietness, but that accuracy in the sprocket must be secured to the same extent as in gears.

Budgeting Tool Disbursements Reduces Waste

Renewal costs of perishable tools cut 71 per cent.

Quality check influences future buying of supplies.

USING materials in the factory is spending money just as much as buying something with dollars and cents. Budgeting material expenditure is just as practicable and just as effective as budgeting financial expenditures. F. A. Mance, in his paper on "Control of Operating Tool and Supply Cost," showed very definitely how these principles can be applied to the use of tools and supplies in automotive production. Such budgeting simplifies handling of tools and reduces waste very materially.

The Studebaker Corporation made a study of the number, value and type of tools used in past years in the production of each unit and thus determined what constituted a reasonable average allotment for the production of a given unit. They are now able to say with some degree of accuracy how much money in tool cost should be allowed to each department for the production of a certain number of cars. The system simply amounts to budgeting tool distribution.

Each foreman is checked up periodically and is informed whether or not he is keeping within his tool cost allotment. He has a very definite interest in keeping down costs and is given a clear picture of just what tool expense means. He has some definite data, moreover, upon which to start work in trying to reduce waste in this particular.

Mance stated that the cost of renewals of perishable tools has been decreased 71 per cent in the Studebaker plant during the four years since the plan has been in operation. Describing the details of the plan briefly, he said in part:

A CONTROL over expenditures for perishable tools and operating supplies has been successfully established by rating or allotting the amounts to be used by each department for every operation. By this allotment we are able to regulate the amounts of tools and supplies that are used throughout the factories in accordance with the number of cars built. Each item is priced and extended, and the aggregate is totaled. The total represents the amount of money allotted to the department to produce a definite number of cars in a given period of time. In figuring departmental percentages of efficiency this amount is included with labor and production.

TO any one interested in adopting this method we would suggest the following procedure: Start with the selection of a competent and aggressive tool-trouble man for making the survey. Provide work sheets on which to list the department, the part number, the operation, the description of both tools and supplies and the amounts allotted for any given number of cars per month. The allotment can be based on the actual withdrawals over a given previous period, after eliminating the waste on account of abuse and improper methods of use where instances of this kind are found. By this we mean that the allotment should be based on the amounts that should be used. These work-sheets are afterward to be used in making up a standard form in quadruplicate. The standard form should contain additional information as to price, the extensions and the total, as previously explained. The standard allotment-sheets when completed are distributed to the foreman interested, the tool or supply stores, the superintendent of the plant and the supervisor of tools or the methods and standardization department.

Deliveries from stores are made upon approved requisitions, provided the article wanted has been previously allotted and appears on the allotment sheets.

Departmental operating tool and supply reports are made up for every 10-day period by the supervisor of stores and show the amounts withdrawn during that period. They are then forwarded to the accounting department for pricing.

From copies of these sheets each foreman is checked as to the amount he is running over or under his allotment and he is allowed to see these copies during each period in order to acquaint himself with the cost of the articles that he uses.

Handling Salvaged Tools

SALVAGED or restored tools are carried in stock and are given out on requisition in the same manner as new tools, with the exception that the requisition is stamped with the word "salvaged" in red ink. This signifies that there is to be no charge against the department drawing out this material.

The department first drawing out a new tool bears the entire cost of the tool.

The tool-salvage department keeps in touch daily with the various department foremen, advising them of available salvage tools, especially when these are in addition to the tools specified on the allotment sheets. The use of salvage tools so far this year has amounted to $1 per car. This sum represents what the cost would have been had we purchased new tools. The amount of money spent to recondition the tools amounted to 30 per cent of the original cost. This 30 per cent is charged off as expense, and is pro-rated over the entire portion of the plant that is benefited by the use of the tools.

One important factor that has a direct bearing on tool cost is the listing of sources of supply. This list is made up by the methods and standardization department and contains the names of the firms whose tools have given us the best results in actual use over a period of from 1 to 4 years.

In connection with the allotment of tools, we have begun recently a study of the life of perishable tools. Among drills this study consists, first, of a microscopic inspection of the steel structure to determine good heat-treatment. Various sizes of drills that show proper heat-treatment are selected and used for drilling steel forgings of a given Brinell hardness. The actual amount of metal removed per grinding is noted, and the drills are compared as regards life per inch of flute length and number of feet of metal removed.

Several charts have been made and an average has been computed for use as a reference in determining the actual life of drills for a given number of feet of steel of a certain range of Brinell hardness.

Non-Productive Departments

IN all non-productive departments the expenditures for operating supplies are controlled by a fixed sum or budget and are based on car production in the same manner as in the productive departments.

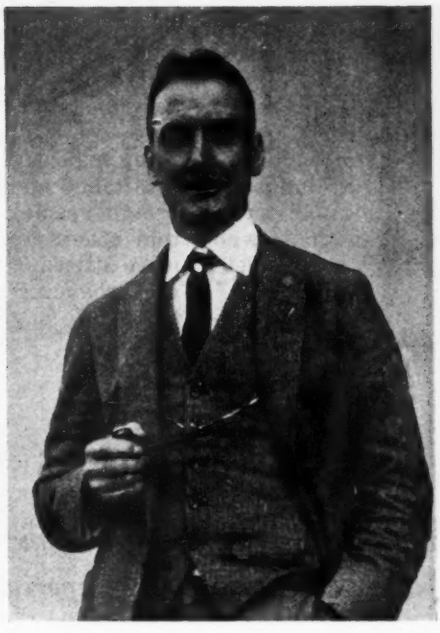
The tool and supply stores are controlled by requisitioning only such items as appear on the allotment sheets. All purchase requisitions from stores must state the amount used in the previous three months, the approximate total cost, the amount in stock at all plants and whether other material can be substituted or salvaged. It is essential that the man who supervises the allotment should check all requisitions before they are approved.

Factory Visits

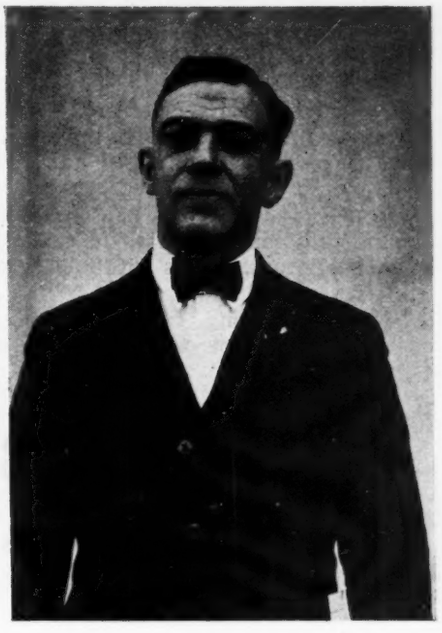
Photos by Lazarnick

1. Ready to start through the Cadillac plant. 2. Buses took the crowd to the factories from the General Motors Building, where the technical sessions were held. 3 and 4. Everybody was ready to sit down after they had walked through the Ford River Rouge plant on Thursday afternoon

H. P. Harrison, H. H. Franklin Mfg. Co., who read the paper prepared by William Dunk, Franklin factory manager



A. J. Baker, Willys-Overland Co., expressed some very definite ideas about buying machine tools



R. K. Mitchell, Maxwell Motor Co., says more attention should be given to special fixtures for general purpose machine tools

How To Buy Machine Tools

Craze for special purpose tools passing. Maxwell and Willys-Overland representatives tell the reason why.

"TIME or rate of production is only one factor that must be considered in the purchase of machine tools. The craze for special purpose and special piece machines is passing. The cost of production, using cost in its broadest sense, is the chief thing to consider in buying machine tool equipment, rather then merely time. Frequently the two do not coincide."

These were the outstanding opinions voiced by A. J. Baker, of the Willys-Overland Co., in his paper on "Selection of Machine Tools." His sentiments were supported heartily by R. K. Mitchell, of Maxwell, in his paper on "Machine Tool Efficiency" when Mitchell said that the high original cost of special machines, coupled with their high upkeep and low resale value, makes it wise to get such tools only really necessary.

Baker pointed out that the source of supply for machine tools in this country is assured, and that there is more than adequate capacity to supply the needs of the automotive industry. He added, however, that progress in design of machine tools of the most economical kind from a production standpoint should not be left entirely to the initiative of tool builders. Production men, demanding certain things, can encourage and make possible more rapid developments.

The chief trouble with the special machines, as opposed to standard types, according to Baker are as follows:

1. The special purpose tool constitutes a heavy overhead charge when not in operation, and will allow overhead to "eat you up" during the slack periods which every plant experiences.
2. The original cost is higher because it has to be specially built.
3. Its resale value is very low. It usually becomes obsolete and must be sold for far less than its inventory value. Thus, your inventory is badly "shot."
4. It is difficult to repair, since the average repair man cannot handle it as he would a standard type.
5. It is harder to service. Replacement parts are harder to get and are more expensive.

Citing an actual investigation which he had recently made, Baker told of getting costs on the replacement of 15 machines which were admittedly obsolete. He figured on replacing these with up-to-date machines of the most efficient type. He found that it would be necessary to spend $132,000 in order to save 32c. per car. The resale value of the old machinery was about $25,000. Thus he would actually have spent $112,000 to save the 32c.

THIS being the case with practically obsolete machinery, he pointed out, great care should be exercised when the replacement of fairly good machinery is contemplated.

When buying machine tools Baker seeks information, not only as regards time, but also as regards the following:

1. Cost per car in labor.
2. Resale value of machine. Can it be resold?
3. Cost of special tools and equipment.
4. Men eliminated by its use.
5. Cars per day with old equipment.
6. Comparative inventory value of old and new equipment.

Finally, he pointed out, the machine tool development needed is that which will come between two extremes.

Labor quality available is low. Therefore the machine cannot be very complicated. Still it cannot be so highly

specialized as to require too skilled repair and upkeep work. The machine of the future will fall between the special piece tool and the very general purpose tool.

He emphasized very strongly the neglect of apprentice training in the automotive industry, stating that this industry has been content so far simply to rob other industries or other manufacturers of its own industry. The need for skilled men is growing and the industry is doing practically nothing to replace the older men who are going out. This situation cannot continue indefinitely.

Following along the general lines of Baker's opinions, and corroborating them in a general way, Mitchell pointed out an additional difficulty in using special piece machines. He said that the average life of a particular design of an automobile part is probably somewhere between six months and a year. Parts design is very unstable. When a part is changed, the special purpose tool has to be changed or scrapped, either process being expensive.

Mitchell spoke also of the "too prevalent tendency to design special tools at the slightest provocation," and told other production managers that they should give more attention to the products of those companies which are producing special fixtures for use on standard type tools. He suggested that all such devices be examined carefully.

Better Brakes and Less Gear Noise

Testing brakes, eliminating engine knocks, and reducing transmission noise discussed by Packard paper. Experimental results given.

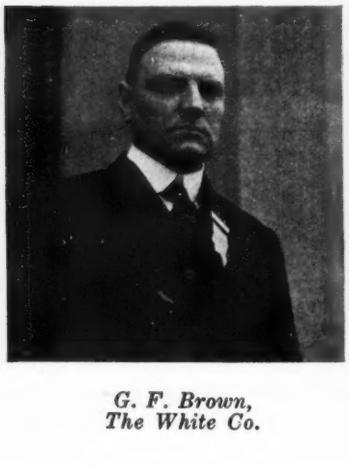
H. J. CRAIN and J. Brodie of the Packard Motor Car Co. told the story of some recent investigations into three production problems that have been more or less troublesome. Their discussion of how to reduce gear noise caused more comment from the other production men than did the other two topics treated in their paper entitled "Some Experiences from a Production Note Book."

They said in part:

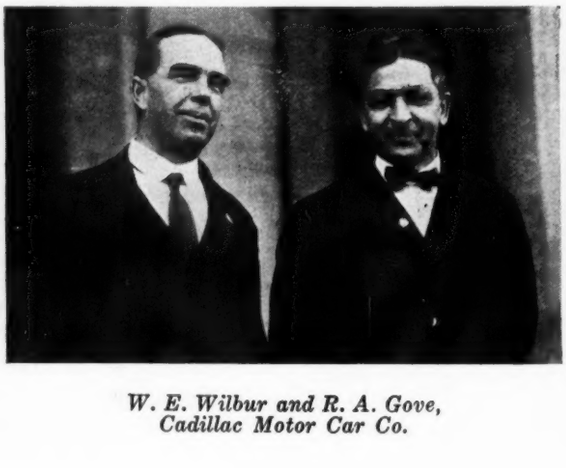
THE increasing congestion on city streets and the seriousness of the automobile accident and collision situation should be convincing evidence of the need of proper adjustment of motor car brakes. It would seem important that cars should be shipped from the factories with the brakes seated, and adjusted to overcome the rapid wear that usually occurs in driving the first few hundred miles.

This rapid wear is caused by the ironing or smoothing of the brake-lining surface until the high spots have been worn down to the level of the rest of the lining face. It may be due also to slight imperfections in the contour of the brake-band. The Packard company uses two motor-driven machines for running them in, one for the expanding and the other for the contracting. The brake drum rotates at a speed of approximately 1000 r.p.m. in both cases. The drums are cooled by water, circulated about the peripheries of the drums so that the temperatures are never excessive. Pressure is exerted on the brake bands by a weighted lever, the weight being adjusted so that the pressure is only great enough to assure a full bearing of the band on the drum. Each band is run for about 1 min. The two machines are located so that the same operator can handle both; the band of one being run in while the operator is loading the other. It will be found that the bands acquire a polished surface on these machines, and that the irregularities sometimes existing around the rivet holes and throughout the lining surface are smoothed out. By taking this precaution at the factory the maximum brake efficiency is attained at the beginning of operation of the car, and the adjustments usually required in a new car after a few days of service are unnecessary.

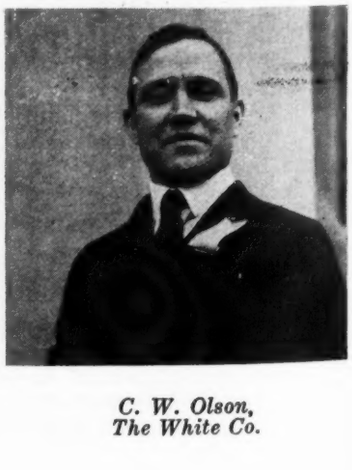
THE importance of accuracy in grinding a piston skirt is recognized by all production men. Excessive wear of the surface of the center necessitated the frequent replacement of this center and demanded constant supervision by the foreman in order that the work should not be spoiled by continuing the use of a center that had passed the permissible stage of wear. The study given to this small but puzzling problem has resulted in the adoption of a center



G. F. Brown, The White Co.



W. E. Wilbur and R. A. Gove, Cadillac Motor Car Co.



C. W. Olson, The White Co.

in which the thrust and driving load are taken by a taper roller bearing of heavy load capacity, the wear is distributed over a very large surface, lubrication is easily maintained and the life of the center is greatly prolonged. This design has proved very successful, and, no doubt, other tool designers could apply it to advantage. This particular center is used with Brown & Sharpe Nos. 12 and 14 external grinding machines.

A Puzzling Engine Knock

ALL production and inspection departments have had the displeasure of running down peculiar engine knocks. The following note from Packard experience may shed some light on this trouble. A few years ago when a new model was started through the Packard shops the engines of the first run received at the test stands were all found to have a perceptible piston slap or knock. Numerous remedies were tried, but eventually the real cause of the noise was found largely through accident.

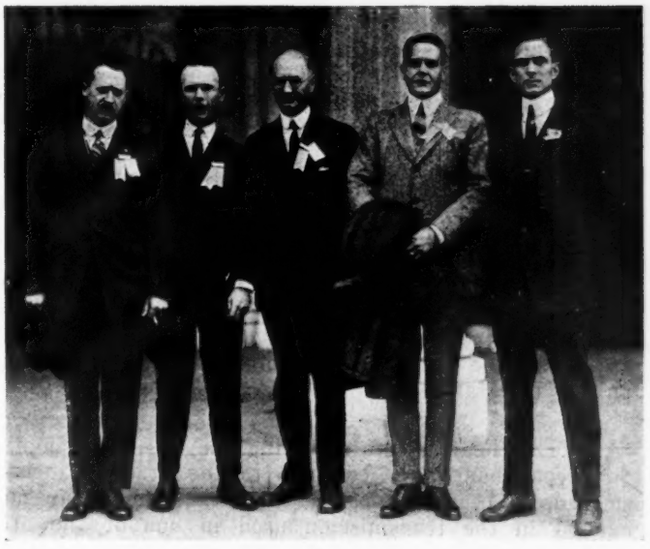
The click came only at the time of the explosion. Investigation revealed the fact that the valves were not centering properly in the conical surface in the cylinder. It was found that the tool used to form the valve test was centered by a spindle inserted in the valve stem guide. This spindle was too much undersize and allowed the tool to float just enough to throw the conical seat out of alignment with the valve stem guide. As a result, the valve spring would not bring the valve fully into the seat; the valve would hang on one side of the valve seat until the explosion snapped the valve into the seat with a very noticeable click. Of course this part of the noise was then obviated without difficulty.

But this correction did not stop all the noise. A more annoying knock was eventually found to come from the piston rings, which were of the diagonal cut type with a slight clearance between the ends. As the explosion-pressure reached the rings they were compressed and their ends snapped. Filing several grooves in the upper edge of the top ring would let part of the explosion in behind the ring, expand the ring and overcome the slap until the grooves had filled with carbon. A ring that slaps in the manner described generally shows bright polished ends. When the proper end clearance had been determined by experiment, the noise ceased. The rings in general use to-day have overlapping joints; the end clearance can be very large, and, of course, this trouble is not encountered.

Causes of Gear Noise

A LARGE number of investigations made over a period of years have led us to believe that gear noise does not always originate in variations of the gears themselves. Such variations undoubtedly contribute to the gear growl or chatter, but the noise can often be cured or dampened by an alteration of another part. We have concluded that the proper mounting of the gears on rigid shafts is a paramount requirement if noise is to be avoided. The most perfect tooth forms, ground, shaped or milled, will not run quietly if they are carried on shafts that spring or are not in perfect alignment. It is assumed that this essential fact is recognized in the engineer's design of transmission and axles. Given a properly designed mounting, it is the factory man's problem to reduce noise. The factors controlling it are largely independent of blueprints. Drawings can only give the characteristics of gear teeth; the production man must see that the actual contours and allowable variations keep them within an acceptable range of quietness.

The front end of a typical transmission is given as an illustration. Particular attention is directed to the mounting of the main drive-gear, which is carried on a roller bearing, the inner race of which is formed by the shaft



C. H. Brennan, W. C Keys, W. R. Strickland, F. B. Ruoff, H. E. Clay

itself and the outer race is mounted in the transmission case. In the final inspection of a certain model at the Packard factory it was noticed that the degree of gear noise varied from very quiet to objectionably loud. Attention, naturally, was centered on the noisy gears. These were returned to the transmission department and torn down for careful inspection, adjustment and reassembling. Invariably the inspection revealed gears, bearings and shafts that were as near perfection as it seemed possible to approach. This led to the assembling of special gears in which perfection was carried to the utmost degree, a state far beyond that possible under even unreasonable inspection practice. But the noise, if anything, was worse.

It remained for us to tear down and to inspect several transmissions that were passed in the final car-test as being quiet. When this was done it was found that the roller race on the shafts had been ground to the low limit diameter, while the roller race in the shells had invariably been ground to the largest or extreme high limit specified for these holes. For purposes of comparison, six noisy transmissions were then torn down, the bearing diameter was ground approximately 0.001 in. under the former low limit and the transmissions were reassembled and tested. This change caused the noise practically to disappear.

Noisy Transmissions

EXPERIMENTS were made repeatedly with noisy transmissions and, in every case, when this alteration was made and the bearing clearance was increased, the noise was either entirely eliminated or was reduced to a degree that was not objectionable. We concluded that this result was produced by providing a sufficient space for an adequate oil-film. Further experiments along similar lines have always found such a clearance to be necessary in crankshaft and connecting rod bearings.

The remedy seemed a simple one to supply, but we were quite concerned about mounting a bearing under conditions that simulated those it would assume after several months' wear. We had always supposed that bearings of the anti-friction type must be mounted snugly. Before definitely adopting the new practice, wisdom demanded that we check the effect of the greater diametral clearance on the wear of the bearing. Transmissions were run under similar conditions with the standard or snug bearing and with the increased clearance. We found that the snug

bearing wore rapidly during the early stages of the test and eventually reached the state of looseness with which the other bearing started. The loose bearing, on the contrary, practically retained its original clearance. We concluded that the wear of the snug bearing was accelerated because of the absence of an oil-film sufficient for complete lubrication. The loose bearing apparently accommodated an adequate oil-film and the wear was normal. The test was continued for some time and frequent examination showed that the snug or full-fitting bearing continued to wear faster than the loose one. This, we believe, is due to the heavy initial wear that breaks or distorts the ground surface instead of glazing it, as seems to be the case when the bearing is assembled with a proper clearance at the start.

AFTER the transmission using the roller bearing had been changed to conform to the practice just described, it became apparent that the same gear noise existed in the transmission used in one of the other Packard models which had the transmission gear mounted on ball bearings. We altered a few experimental ball bearings by deepening the grooves in the races to allow a minute clearance for the balls, instead of assembling them to a good rolling fit or to the fit of the standard stock. This was done to provide oil clearance, as had been done with the roller bearings. When the loose ball bearings were substituted for the tight ones in noisy transmissions, our previous experience was repeated and the noise decreased. Careful experiments determined the desirable clearance to allow in the races for the reduction of noise, and the manufacturers of ball bearings agreed to supply bearings with various amounts of clearance so that we could determine the requirements of this work.

It was a comparatively easy matter to determine the clearance needed in the case of the roller bearings since diametral clearances could readily be measured. It was found to be difficult, however, to measure radial clearance in the ball bearing races and we were forced temporarily to determine the degree of clearance by the end play or axial looseness. A maker of ball bearings prepared the nomographic chart for the purpose of converting a desired radial clearance into the equivalent axial play. This enabled us to order bearings with a selected radial clearance, which could be held uniform without demanding a finer tolerance from the bearing maker, and cured the gear noise most effectively.

The amount of clearance to be allowed in any case cannot be determined by rule. We have found that it varies in transmissions similar in design but differing in detail dimensions. Our experience leads us to believe that each mounting must be studied individually, by varying the looseness of the bearing until the suitable amount is apparent. In the ball bearings referred to, a total radial clearance of from 0.0006 to 0.0009 in. was found the most satisfactory.

FROM the two cases cited we judged that the same reasoning might apply in determining the proper allowable backlash in gear teeth. Here, again, there is a possibility of not providing sufficient room for a film of lubricant, of squeezing all the oil out of the meshing space, and of causing increased noise. Experiments with gears identical in every respect except in the amount of backlash showed that a very evident drop in the noise of the gears was produced when the backlash was increased to a certain point.

EXPERIENCE in several plants indicates that anti-friction bearings which have been set up too tightly, particularly in transmission work, are noisy. Room has to be left for the oil or else a noisy bearing will result. This was the first point brought out in discussion on this paper.

H. M. Crain asked if it would be possible to make the ball bearings a loose fit in the outer housing. A negative reply was made to this. It was stated that such practice would permit the outer housing to spin in the mounting. Moreover, it is very difficult to measure end play in a bearing as end play depends very largely on end pressure. A far better measure to use as a guide is that of a radial looseness.

George Goddard asked if oil pumping does not increase with the bearing clearance. The opinion was that this is not necessarily so. As a practical measure of proper clearance, the inner race is held tightly and if it is tried by hand to slip the outer race over the ball, a good check may be had on clearance. If the race can be slipped, it may be generally taken for granted that the clearance is about correct.

Problems in Air-cooled Engine Production

Making cylinders, manufacturing a case-hardened crankshaft, and machining duralumin connecting rods topics treated.

PRODUCTION of air-cooled cylinders, making case-hardened crankshafts, machining duralumin connecting rods and experiments with a hot-swaged rear axle drive-shaft were discussed in the paper prepared by William Dunk, production manager of the Franklin company.

"The design of the Franklin cylinder necessitates the use of unit-cylinder construction rather than the regular block-cylinder design," Dunk said. "This fact makes the production of the cylinder a somewhat different problem from that of machining a block casting. In the Franklin cylinder, the head is cast integrally with the body of the casting and steel cooling fins are cast in the outer surface of the cylinder-wall.

"The foundry practice in connection with the production of these castings is of interest. The mold is composed of three distinct sections, the lower section being an assembly of dry-sand cores for making the head of the cylinder and the valve ports. Next above this section is a green-sand section containing the cooling fins, and the upper section of the mold is a green-sand section for the neck of the cylinder between the cooling fins and the bottom flange, the cylinder of course being cast in an inverted position. The core assembly for the head of the cylinder is made up of five unit-cores that are made separately and assembled by pasting-in an accurate pasting jig so that the valve-port cores are held accurately in position while drying. The valve-port cores are provided with prints that are used to locate the upper end of the main cylinder-barrel core; for this reason it is necessary to be very accurate in the location of the port cores.

"In making the green-sand section containing the cooling fins, the cylinder pattern is milled longitudinally with

the proper number of grooves to receive the vertical cooling-fins. These grooves are 1/16 in. in depth, which corresponds to the amount that the fin is imbedded in the cylinder-wall. This section of the mold is made on an air-operated ramming-machine provided with a sand hopper directly above the mold. A very small amount of sand is used in this section of the mold, not over 2 in. of sand being provided outside of the cooling fins. The fins are held in place in the cylinder pattern by simply wrapping a piece of soft iron wire around them and twisting the ends tight. This wire remains in the mold until the casting has been made, and serves to keep the section of green sand that lies within the cooling fins from sagging below the rest of the mold. The upper section of the mold is also made in green sand and is located on the center section by taper dowels. The last operation in making the mold is the lacing of the cylinder-barrel core and the strainer-gate core through which the metal is poured. The cooling fins are made of ordinary cold-rolled strip-steel which has been tinned and folded to a right angle about 5/16 in. from one edge. These cooling fins, when placed radially about the cylinder pattern, form a completely enclosed air-jacket.

"The greatest source of casting loss that we experience in making this piece is caused by loose flanges. Unless the flanges extend at least 1/16 in. below the surface of the cast iron, they will not be properly held in place."

Another interesting manufacturing detail is the Franklin case-hardened crankshaft, which has been in production for the past 2 years. This process was described in detail in AUTOMOTIVE INDUSTRIES of Nov. 18, 1920.

Connecting Rods

Describing the Franklin method of machining connecting-rods, Dunk said:

"THE Franklin connecting-rod is an aluminum-alloy forging, either of duralumin as furnished by the Baush Machine Tool Co. or of 17-S alloy furnished by the Aluminum Co. of America.

"The elastic-limit of the forging is between 30,000 and 35,000 lb. per sq. in.; the ultimate-strength is between 50,000 and 55,000 lb. per sq. in.; and the elongation is from 15 to 25 per cent.

"The forging is heat-treated by heating it to 920 or 940 deg. Fahr., and is quenched in boiling water. It is then allowed to age about 1 week to bring it to a scleroscope hardness of 90 to 100.

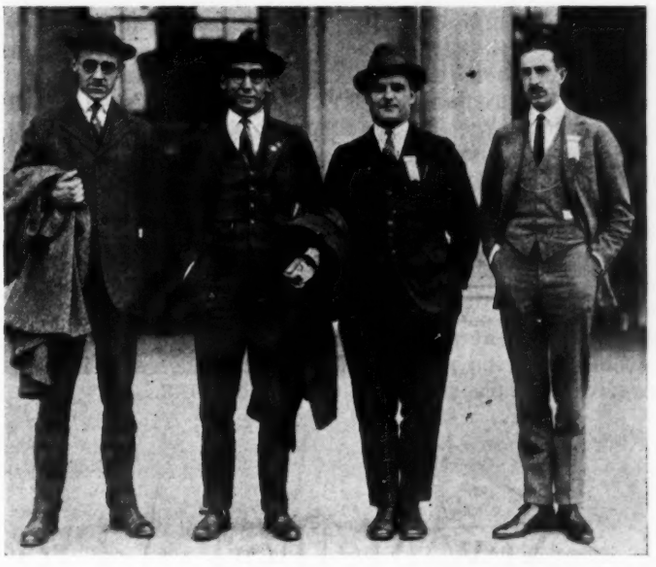
"We use about the following procedure in machining the duralumin forged connecting-rod. The forging is first coined under a heavy toggle-press, bringing the length of the wristpin and crankpin ends to within 0.025 in. of the finished size. It is then loaded onto a special fixture on a Blanchard grinding machine that has alternate roughing and finishing stations. It is ground first on one side, then removed from the roughing station, moved to the next adjacent station and finish-ground on the other side. A special multiple-spindle boring-and-reaming machine having an indexing table is used for boring and reaming the wristpin and crankpin holes. The operations which this machine performs are to rough-drill, rough-ream and semi-finish ream.

"The action of the forging in these machining operations is similar to that of mild steel. The power required to drive the drills and reamers is approximately the same as the power we employed formerly with our steel connecting-rod, and the cutting speed does not exceed that for steel by more than 25 per cent. In machining this forging, it surprised us to find that it machined so nearly like a steel rod. We had anticipated being able to machine this rod at a much greater speed than we found possible. The extreme toughness and wire-like quality of the chips are convincing proof that the metal with which we are dealing is something more than ordinary aluminum.

"The forging is next drilled for the rod bolts and is then put over a multiple fixture for parting the cap from the rod and facing the seats for the bolts and nuts. A broaching operation follows for providing slots in which the lower-end babbitt blocks are locked. These babbitt blocks are forced into place and broached to their semi-finished size in an ordinary two-spindle broaching-machine.

Finishing Wristpin End of Rod

"THE finishing of the wristpin end of the rod has been rather difficult, because it is impossible to ream a sufficiently good wristpin hole in the bearing end. Our present method of handling this operation is to semi-finish ream this hole, removing about 0.025 to 0.030 in. of the diameter, then to use a final reaming operation that removes about 0.005 in. and a final burnishing operation that is done with a high-speed burnishing-tool under a copious



C. F. Scott, M. P. Rumney, L. C. Hill, K. K. Hoag

flow of regular medium automobile motor-oil. We find that by leaving a uniform amount of about 0.0005 in. on the diameter we can produce a highly burnished surface in the wristpin hole and maintain very uniform size. However, to obtain the fits required by our engineering department between the wristpin and the connecting-rod, it is necessary to do a certain amount of wristpin selection. When it is finally finished, the alignment of this rod is held to a limit of $\pm$ 0.005 in., measured between the ends of arbors 12 in. long.

Final Operations

"THE finishing to size of the lower end of the rod is left until it is ready for assembly with the crankshaft. This operation is performed on a special type of boring machine in which we use boring bars of five separate diameters, increasing their diameters in steps of 0.00025 in. from the minimum size required up to the maximum; this allows us to cover the entire range in the crankpin bearings with the proper amount of oil clearance. At this time we use an oil clearance of about 0.001 in. for this bearing.

"The weight of the finished connecting-rod runs very uniform, it being necessary to maintain but two standards of weight to keep within the limits specified by our

engineers, which are a variation in weight of any two connecting-rods on an engine of not more than 0.2 oz.

"WE have been experimenting for the past 18 months with the production of drive-shafts by the hot-swaging process but, up to the present, we have not felt justified in following this method of manufacturing in large production quantities. The saving in the amount of material used to make a rear-axle drive-shaft, and the reduction in the amount of labor required by this method, make it a very attractive proposition, and we are not inclined to give up the idea without a struggle.

"Troubles have developed in the source of our experiments. We have been unable to obtain a swaging machine of a construction heavy enough to withstand the load put upon it by an operation of this kind. We had experienced continued breakdowns of our original machine, and we have practically rebuilt it. The problem of producing a swaged shaft, without having the finished product show any twisting effect whatever from the swaging, has been difficult.

"IN performing the second swaging operation, which consists of necking the shaft below the diameter of the splined end, we have not been able to reheat for this operation without excessive scaling, which mars the appearance and reduces the strength of the finished shaft. The procedure that we are following at this time requires three separate swaging operations and three separate heats for making them. If it were possible to take the shaft directly from the first swaging operation and bring it up to swaging temperature again, which is about 2000 deg. Fahr. in our case, and to perform the second or necking operation immediately, we believe we could reduce the amount of twisting and the amount of scaling that we experience at present. The third swaging operation, that of producing the taper and the threaded end, is comparatively simple and gives us no trouble.

"We are now considering the installation of a much heavier swaging machine. We find it can be built to order for us. We are considering also the installation of a second furnace to be used as a booster between swaging operations Nos. 1 and 2."

DUNK'S paper was read by H. P. Harrison, of the Franklin organization. Discussion centered about such topics as foundry scrap, character of bearing metal, ease of starting, etc.

Harrison stated that foundry scrap runs about 10 per cent, while machine shop scrap is less than 1 per cent. He made clear that the bearing metal employed is a hard die-cast babbitt. The groove is not the customary oil groove, but a small pocket on the back of the bearing.

One questioner asked why the Franklin company feared scale accumulation in the re-heating processes in swaging. In reply to this, Harrison stated that the Franklin company worked so close to the limits of the shaft that they did not care to stand the chance of abrasion of the surface sometimes found with scale.

Ease of starting of the Franklin car in winter was questioned. Harrison replied that an electric primer consisting of a solenoid coil for pre-heating the gasoline had solved the difficulties of winter starting. Furthermore, he said, the new pressure type cooling system has made it possible to raise the compression to about 4 atmospheres.

Questioned concerning the relative weight of the steel connecting rod and the duralumin rod at present employed, he stated that the steel rod, with a 1⅝-in. crankpin, weighed 2 lb. as compared with 13 oz. for the duralumin rod with a 2 in. crankpin.

The high scleroscope value of the case-hardened crankshaft and the preparation of the shafts for case-hardening were discussed. Harrison stated that hardness as low as 750 scleroscope had been employed, but usually it was between 800 to 1000.

New Method of Processing Splined Shafts

Piece is drawn through a die instead of being ground as in the past. Warpage overcome. Finished shaft accurate.

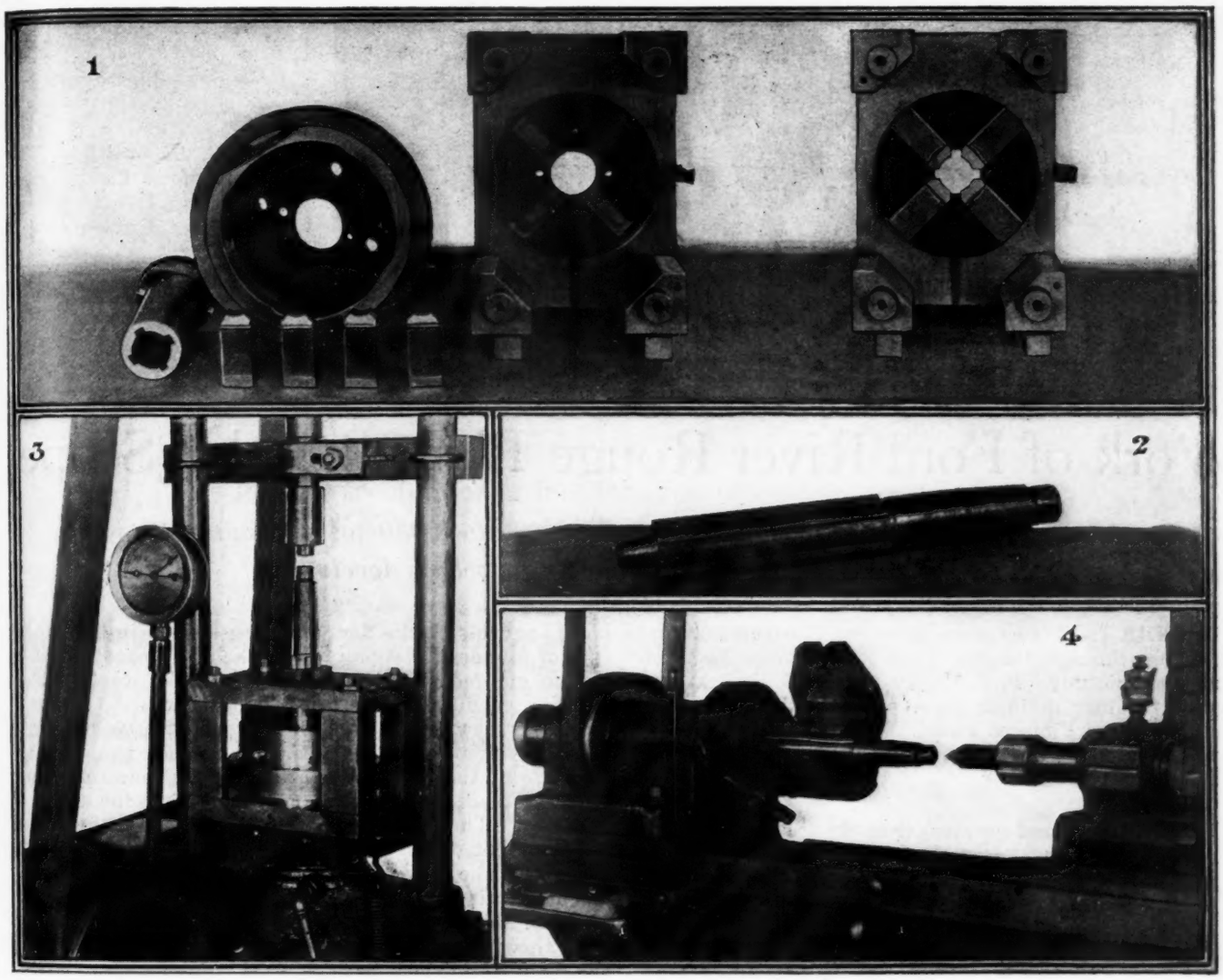
IN order to meet the difficulties of securing accuracy of the finished spline shaft the process herewith described, in which the shaft is drawn through a die after it had been carbonized, has been put into use by the Studebaker corporation. The general practice among manufacturers of transmissions requiring a spline shaft has been, for many years, to finish the spline and body portions of the shaft by grinding after hardening; but it has been found that this process demands extreme care in obtaining and maintaining the desired form.

Details of this new method are given in the paper presented by James A. Ford of the Studebaker Corp. He said in part:

THE die shown in Fig. 1 is constructed according to the same principles that apply to the automatic threading-dies now in general usage, the cutters being in the position that the die chasers ordinarily occupy. In the right-hand part of Fig. 1, the cutters are shown installed in the die. The cam ring is practically of the same construction as that used on a threading die, except that the ring is made stronger. This opening feature is necessary on account of having to pass the shaft back to the die, because the body of the shaft beyond the splines is larger than the body portion between the splines and the shaft will not pass completely through the die. This is illustrated clearly by the view of the shaft shown in Fig. 2.

THE shaft is entered into a bushing that is lined up with the die. Then the shaft is pressed through the die to a stop that has been set at a sufficient distance to permit the shaft to pass through to the shaft neck at the end of the splines, as illustrated by Fig. 3. The cutters in the die are then released and the shaft is removed.

During the experiments with this die it was ascertained that a clearance angle on the cutter of thirty



1. *Cutters installed in die.* 2. *Detail view of shaft.* 3. *Pressing shaft through die.* 4. *Re-centering shaft by grinding against pencil-shaped grinding tool*

minutes was about correct, and it was decided that one pass of the shaft through the die gave the most satisfactory result.

Up to this point we had a shaft that was carbonized, and its body and splines were finished to the dimensions desired. After hardening a number of shafts, we were able to determine just what change took place in them, and an allowance was made for this in the adjustment of the die. The change was uniform to a reasonable degree in all shafts, and this enabled us to determine what the standard allowance should be.

THE next problem was that of overcoming the warpage in a shaft after it had been hardened. Fortunately, we found that this warpage was outside of the splined portion of the shaft.

It was very difficult to revolve the shaft on its centers and straighten it to the degree of exactness required, and the operation required too much time. However, we found it possible to straighten the shafts easily to within 0.005 in. per ft. of being parallel with the true axis of the shaft. Therefore, we straightened the shafts to within the 0.005 in. per ft. limit.

AFTER having been hardened and straightened to within the 0.005 in. per ft. limit, the shaft is gripped in a fixture mounted on the spindle of an internal-grinding machine, as illustrated by the two views shown in Fig. 4. It is then revolved true with the splines while it is being re-centered by grinding against the pencil-shaped grinding-tool, shown also in Fig. 4.

After the new centers have been established true with the spline portion of the shaft, the remainder of the operations follow ordinary shop practice.

The process described by the author was devised to eliminate the difficulties incident to the finishing of the splined and body portions of a spline shaft, such as is used in transmission gearing, by grinding with a formed wheel after the shaft has been hardened, and is the result of a series of experiments.

THE accuracy of the finished shaft was the primary consideration and three other groups of important considerations are stated, as well as four specific difficulties that were expected to appear upon departure from former practice.

Illustrations are presented to show the tools used, and the method of using them is commented upon step by step. The shaft can be straightened to within 0.005 in. per ft. of being out of parallel with the true axis of the shaft, after the shaft has been hardened and it is then re-centered true with the spline portion.

I. B. Scofield
Ford Motor Co.

P. E. Haglund,
Ford Motor Co.

Work of Ford River Rouge Plant Broad in Scope

8000 *cylinders per day in* 1922 *contrast with* 70 *per day in* 1907. *New cylinder molding machine developed.*

PRODUCTION men were given an illustrated lecture tour through the big Ford River Rouge plant on Thursday morning. P. E. Haglund and I. B. Scofield conducted the tour in their paper entitled "Cylinders from the Ore to the Finished Part." The paper was an excellent preliminary to the actual visit made to this plant on Thursday afternoon.

THE authors traced the steps from the ore to the finished cylinder castings.

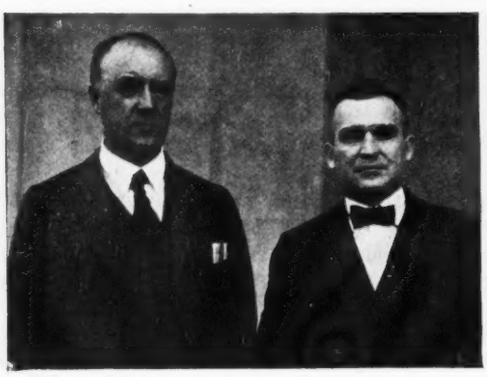
The work is conducted in such a way that the ordinary pig iron stage is eliminated. As explained by P. E. Haglund, the fact that the pig iron stage is eliminated does not mean that the castings are made directly from the product of the blast furnace, as has often been reported. It is necessary to draw from the cupola to secure the proper analysis for the iron before the castings are made. The plan, however, does eliminate the stage in which the iron is run into pigs, thereby eliminating the wasted heat lost by re-heating this amount of metal.

The authors contrasted the present methods in which 8000 cylinders are cast per day with those used in 1907, when 60 per day was good production. It would be impossible, as they pointed out, to cast the 8000 cylinder blocks per day on the floor, as is customary in the usual type of foundry. Not only would the floor space required be too enormous, but the gas and smoke would make working conditions practically impossible.

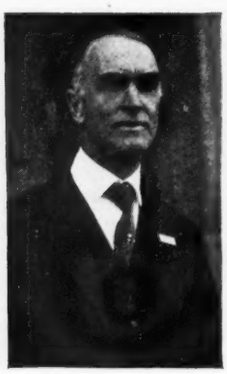
In this new plant, two big economies have been effected by first bringing the ore to the men and thereby cutting out the cost of transporting the material from place to place, and second, by decreasing the cost of material. The latter, of course, has been the most difficult; but, by mining practically all their own iron and coal, the Ford Motor Co. has been able to accomplish this result. The body of this paper consisted of a step-by-step description of the coal and iron ore from the time it leaves the mines until it passes through the plant as finished castings or as valuable by-products.

AN interesting point brought out is that the only waste in product of the plant, that is the slag, is soon to be utilized for cement and will be used largely for construction work at the Ford plant.

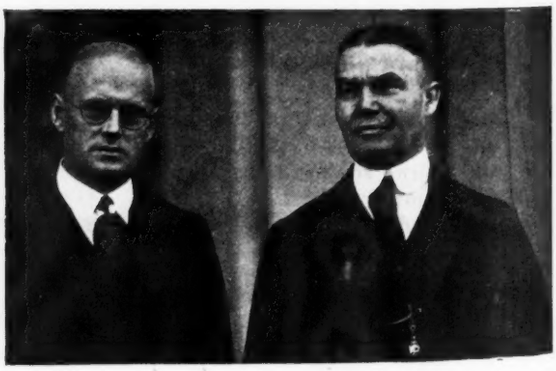
Another interesting development is the new cylinder molding machine which is now being experimentally studied. If this proves out as it promises, another step toward the elimination of manual labor will have been made.



W. J. Alles, Dodge Bros.
F. J. Lamborn, Dodge Bros.



N. C. Banks,
President Gear Grinding Machine Co.



F. T. Ellis, Cadillac Motor Car Co.
A. V. Widman, Cadillac Motor Car Co.

S. A. E. Production Meeting

Production Errors in Gears

Difficulties in manufacture have more influence on gear sounds than changing pressure angles, steel or tooth form details. Causes of trouble found in hardening process, cutting machines and in some cutters. Methods of checking gears in production.

MOTOR-CAR production-men, as a rule, do not lay claim to being specialists in all the various arts and sciences that enter into the finished motor-car; so, in the matter of gears, we do not pretend to know all the details that enter into their design and production. Very few of us are familiar with the mathematics relative to the involute gear-tooth forms that the engineering fraternity stresses considerably in connection with gear noise. We are much more familiar with the noises of the finished product, which are recognized as knock, rattle, growl, hum and sing. When these occur, naturally those men who have made a life study of gear subjects are called in, and they make recommendations.

As a rule our gear experts offer widely varying remedies for the same cause. If one is using a 20-deg. pressure-angle, we can advise a 14½-deg. angle and have a large number of supporters in both the engineering and the production fields. If both 20 and 14½-deg. angles have been tried, we can easily advise a stub tooth or full length. If all six combinations have been tried, it is easy to recommend topping-off or no topping-off; and, if this does not work, we recommend a different *steel, cutting machine* or *cutter*. While all of this goes on, sufficient time has elapsed to start all over, with the first recommendation. Of all these recommendations we find many past and present supporters of national reputation.

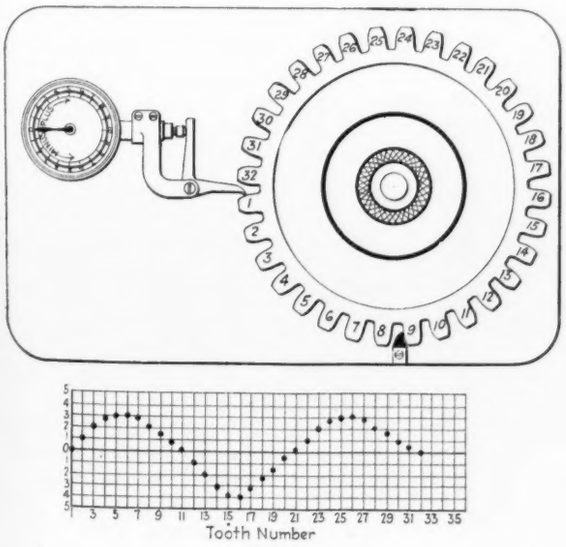


Fig. 1

It is the purpose of this paper to show that production variables have a much greater influence on gear sounds than changing pressure-angles, steel or tooth-form details; also, by showing the errors present, to obtain definite help from the gear-cutting tool and the machine designer. We will confine this discussion, for the time being, to the transmission, which is the simplest type of gearing used in the motor car.

Gear Noises

WE have already referred to the various kinds of gear noise. The first is a knock that might be caused by a nicked tooth or a single tooth of a pair of running gears that are in mesh. If this single tooth or nick happens to be in the transmission constant-mesh pinion and it is driven at 1000 r.p.m., there will be 16 distinct blows per sec. Elementary physics show that, up to this point, these blows can be distinguished by the human ear as individual blows. With this same gear, rotating at 1000 r.p.m., if there are two nicks and they are a uniform distance apart in the gear, the gears will have 32 knocks per sec. This noise still will be distinguishable as individual knocks by some ears, but by others it will be noted as a distinct tune. However, if the two nicks happen to occur in this gear an uneven distance apart and the transmission is speeded up, one can note readily the place where the gear noise changes from an individual knock into a sound that is usually designated as a rattle.

It is evident that influences similar to the nicks referred to above can be produced by inaccurate conditions in the gears. For example, should the tooth spacing in the transmission drive-pinion mentioned be such that the driven gear, instead of rotating at a uniform speed, is forced to increase and decrease its speed at every revolution of the

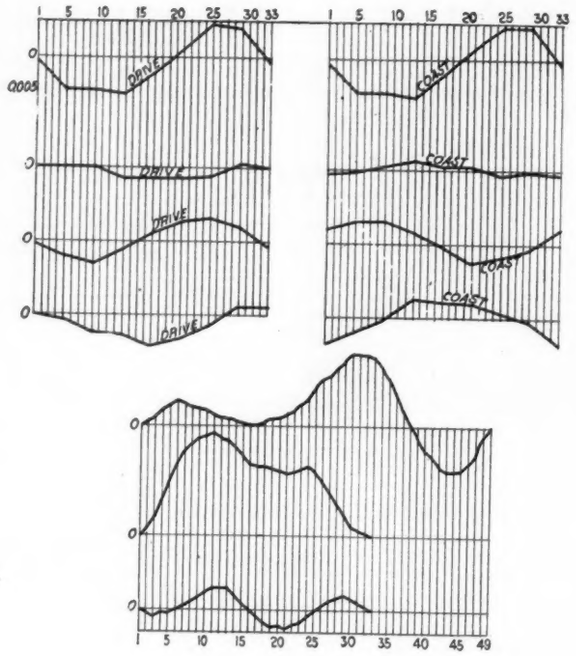


Fig. 2

pinion, very similar sounds will occur. If on one side of the driving pinion the teeth are 0.015 in. ahead of their proper position on the periphery of the pinion, the driven gear must gain and lose a corresponding amount in its steady motion. In so doing, it may strike on the back of its tooth rather than on the driven side, especially when idling, and produce a series of blows which still further increases and confuses the rattle.

It is not sufficient to check gears for spacing error from tooth to tooth. It is very desirable to check the accumulated error of a number of teeth, because a gear may vary 0.001 in. from tooth to tooth. With eight successive teeth each gaining 0.001 in. on the side of the gear and a similar number of teeth that may be losing 0.001 in., a total error of 0.016 in. might be imparted to the driven gears.

Fig. 1 illustrates a very simple device that has been used for checking tooth spacing. The gears are mounted on a bushing and one tooth comes against a stop. A dial indicator is arranged so as to be in contact with some tooth one-fourth, one-third or one-half way around the gear. When the dial indicator is set at zero, with the tooth against the stop at any one point, the distances between the two points can be measured and, if the gear be correct for indexing, placing any of the two teeth in the gear in similar positions should not cause the dial indicator to vary, especially if the gear runs true.

Checking Tooth Spacing

WHEN the gear is first put on the indicating apparatus, the dial indicator is set at zero. We then put a mark at zero on the chart in Fig. 1 for tooth No. 1. The next step is to index the gear around one tooth. Any reading obtained is marked above the tooth number in the vertical line. We next index the gear around to tooth No. 3 and again mark the dial-indicator reading opposite the number of thousandths of an inch that it may show. The gear is then indexed to teeth Nos. 5, 6, etc., until all the teeth on the gear have been indexed.

For the purpose of record, we now have a chart showing the accumulated variables. It will be seen from Fig. 1 that at no point is the spacing variable as great as 0.001 in. between any two teeth, but it can be in error a total of 0.008 in. or more when the error between the several teeth has accumulated. A better visual demonstration of this condition occurring in gears is made by means of a gear-tooth-form projector. When a gear-tooth-form is projected upon a screen by this device, it will be noted that the magnification of the shadow is 100 to 1 and that, for every inch on the screen there is at least a 0.001-in. error somewhere in the gear. The shadow on the screen also shows the variation in uniform movement of the driven gear due to an error of this kind; that is, the driven gear, instead of having its tooth in the position of the outline on the screen, has been forced to advance a number of thousandths of an inch. It will be noticed further that this advance and retardation does not occur uniformly; that is, the advance may be confined to a very small number of teeth, remain there for a certain length of time and then be retarded slowly. A gear in this condition will give a rattle very similar to that which might be produced by unequal spacing. This condition can be studied best by charting it as described.

Variations in Finished Gears

A NUMBER of variations as they occur in the finished gear are shown. Fig. 2 shows, first, a rapid drop, then a flat portion showing no change, then a rapid rise, another flat and then a return to the starting point. These curves require very little explanation.

It requires considerable imagination to determine just what happens when a driven gear such as those described is meshed with a driving gear having teeth misplaced as shown in Fig. 3; yet this occurs in daily practice. Fig. 4 shows a gear and pinion neither of which has an index error of more than 0.005 in.

In addition to the two gears having a rather irregular action between themselves, their increasing and decreasing movement is carried on to the countershaft and the idler, which often have similar defects in themselves. Accumulating errors in gears often carse the fourth gear in a train to be as much as 0.25 in. away from its correct position and this change occurs in varying amounts depending on the number of teeth in the gears of the gear train. From this it is seen readily that the countershaft does not rotate smoothly and that the gear on the other end of the countershaft, in addition to the variable movement given it by the errors in the first two gears, imparts its error to the gear meshing with it. The action of the fourth gear will also lack uniformity in addition to that imparted to it by the driving gear, to the extent of the error on the fourth gear. If the ratios between the gears

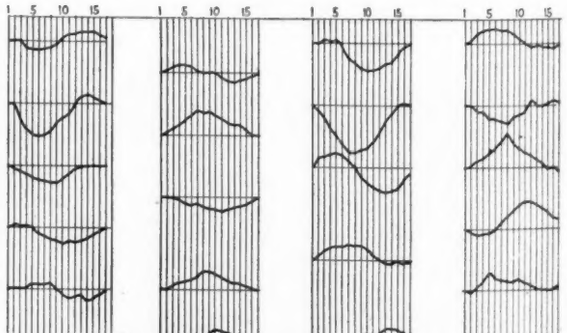


Fig. 3

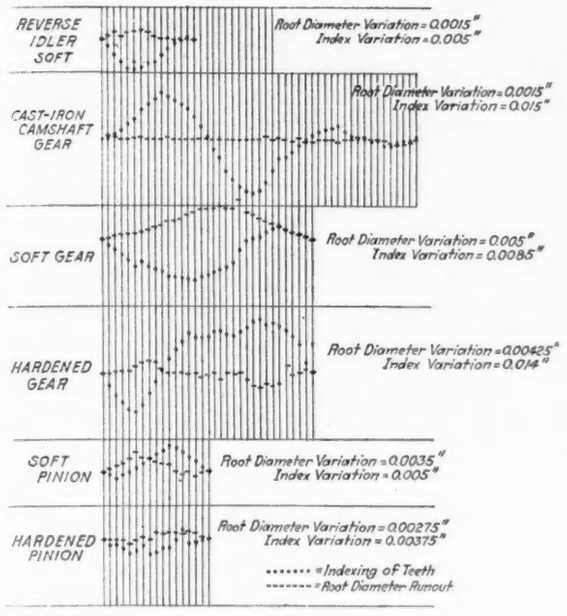


Fig. 4

referred to are a direct proportion such as 2 to 1, these several shocks will occur uniformly, the error of the first uniformly with each revolution of the respective gears; however, if the ratios should be odd, such as 16 to 31, it will be difficult to estimate the change of speed that takes place.

Hum or sing is not nearly so difficult to analyze as the matter of rattle in a transmission gear. With this same transmission run at a speed of 1000 r.p.m. at the pinion shaft, if the pinion should happen to have 16 teeth, it will be found that 250 teeth per sec. go into and out of mesh. If the teeth are not correct in shape and the gears are under a slight load, there may be 250 blows per sec. under certain conditions, which we are told corresponds to the tone of middle C on the piano. Should fewer teeth go into and out of mesh, and this may be caused by a slower speed, a much lower pitch can be produced. In a similar way, because of the speed reduction that occurs in the usual type of transmission between the drive pinion and its countershaft, the tone produced by the reverse idler is very low and, instead of producing a hum or sing, it will produce what we usually call a growl. Errors in the sliding gears, because of their higher speeds, will produce higher pitch growls and approach a hum.

A GREAT many instruments have been developed for the purpose of analyzing tooth-forms producing these sounds. The one that we have worked out and have chosen to use is shown in Fig. 5. It consists of a dial indicator mounted on a guided slide. We place the gear in a definite position with respect to the indicator, start at the point of the tooth and set the indicator at zero. The slide is then moved toward the gear 0.010 in. and the indicator-reading marked on the chart shown in the lower portion of Fig. 5. The slide is then moved 0.010 in. more, the reading is marked again, and this is continued until the bottom of the tooth is reached. By taking the gear that has just been charted off the bushing and placing another gear in its place, other tooth-forms will be compared with the first.

The charts reproduced in Fig. 6 show some variations occurring in production, these particular charts having been made from gears with which special care had been taken to secure good gears. This was done by men who were not previously familiar with the method that was going to be used for the gear inspection. Fig. 7 shows some curves that occur in production from the same hob, and also curves made at different hours of the day.

Cutting Machines

THE causes of the errors referred to are various. Some of them occur in hardening, some in the cutting machines and some in the cutters. We have found these errors in all of the types of machine that we have used. For the purpose of this discussion we are selecting a hobbing machine.

The hob is a generating tool that produces a gear such as is shown in Fig. 8. It will be seen readily that if all tooth-heights of the hob are the same, each hob-tooth generates, roughly, a flat in the tooth-form. If any of the teeth in the hob is high, a wider flat will be produced as shown in Fig. 9. Should the tooth-heights be correct and the hob be mounted in the machine with a run-out, a leaning tooth can be produced, depending on the sideways setting of the hob with the gear. Also, should the hob be correct and the end-thrust collar in the hob spindle be out of parallel, giving the hob a slightly reciprocating

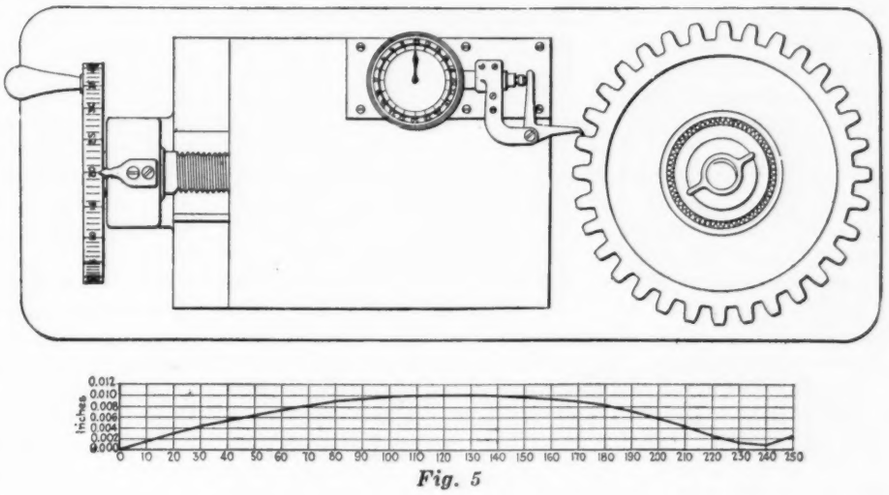


Fig. 5

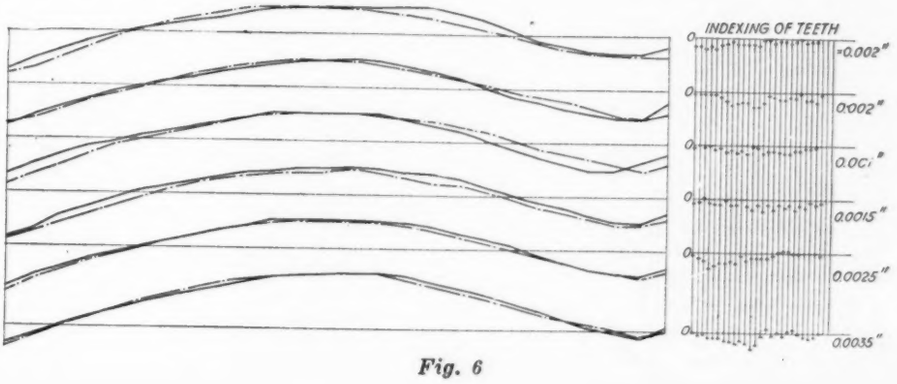


Fig. 6

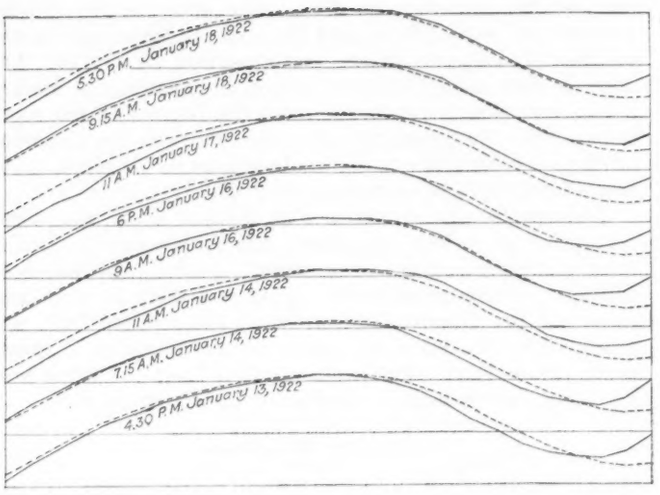

5.30 P.M. January 18, 1922
9.15 A.M. January 18, 1922
11 A.M. January 17, 1922
6 P.M. January 16, 1922
9 A.M. January 16, 1922
11 A.M. January 14, 1922
7.15 A.M. January 14, 1922
4.30 P.M. January 13, 1922

Fig. 7

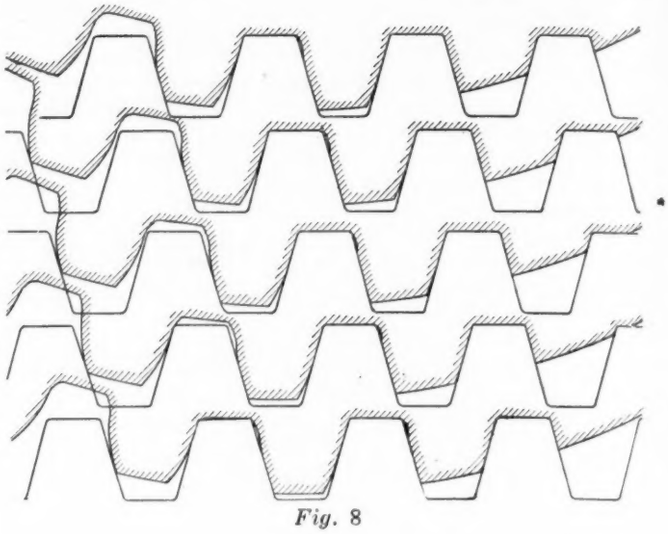


Fig. 8

motion with each revolution, an error can be produced that may compensate for the hob run-out or may add to it. Should the thrust collar at the rear end of the spindle be adjusted loosely so that the spindle may have end-play, the hob, as it cuts on one side, will be forced over and then back with each tooth of the gear and produce corresponding errors in the tooth-form. Again, if the gears in the hob-grinding spindle have inherent index-errors in them, or should the gears driving this gear be concentric or improperly spaced, their errors will be transferred to the different teeth of the gear being cut. If the hob spindle is tight for a portion of the revolution and loose for a certain portion of the revolution, a sagging will occur in the driving-gear train which will be very detrimental to the tooth-form. Some hobbing machines are built so that the bevel gears in the hob drive-spindle give a thrust in the opposite direction to that given by a spiral pinion driving a hob-spindle gear. This permits a back-and-forth movement of a hob-spindle drive-shaft which leaves its impression on the tooth-form.

IN most hobbing-machines the bearings are kept fairly tight, and a great many operators insist that the hob spindle be kept warm. This also applies to the worm-shaft driving the wormwheel and, to a certain extent, to the work spindle. Unless the machines are extremely well adjusted, the thrust collars on the spindles so fitted score very easily and cause the spindles to be tight or loose, depending on various portions of its revolution. This causes a corresponding sag in the gears driving the *index* worm-wheel and seems to be the main cause of the index errors already referred to. Another source of error is looseness in the gibs of the hob saddle. It is very difficult to move the hob slide from the face of the tooth without having some play between the gibs. This amounts, in a very similar manner, to the error that is obtained by having end-play in the hob spindle. Another contributing error to tooth-form is depth of cut. There will be considerable error in the tooth-form if the hob is sunk several thousandths of an inch too deep. Should the hob be straight-sided, the pressure-angle will increase with the depth of the cut and decrease as it is raised above the pitch-diameter. Another factor having considerable influence is the outside support for the hob spindle. We have had considerable difficulty in placing this outboard support of the hob spindle back in exactly the same place, giving us exactly the same condition of hob spindle as before.

When the work spindle is caused to rotate ahead of or behind its proper position, we necessarily have certain tooth-form errors in addition to index errors, and also in addition to those produced by the hob, its spindle and driving mechanism. There are conditions under which some of the errors referred to are counterbalanced by other errors. However, there are also conditions in which these errors accumulate. Considering the number of gears in a hobbing machine and the number of possibilities for errors outside of these gears, it is largely a matter of chance whether suitable combinations can be obtained to produce proper tooth-forms.

OF the various kinds of gear that we have cut and which we have had cut for us by a large number of different manufacturers, we have found that the errors from a general definite shape have apparently more to do with noise than any existing type of gear. The nearer to being correct a 14½-deg. pressure-angle-tooth gear is, the quieter it will be. We have never yet been able to secure 14½ and 20-deg. pressure-angle gears that had similar errors. The indications are, however, that the differences in sound due to the differences in the pressure-angle are very slight when compared with the differences in sound due to different errors in the same gear. We are using 14½ and 20-deg. pressure-angle gears regularly in production, and there is little to choose between them.

The details of tooth-form are of some importance. Continuing with transmission gears, Fig. 10 shows the first layout which we make. This is with a view to determining the amount of tooth length necessary to give a 100-per cent arc of contact. With this information in hand, we select a hob form such as is shown in Fig. 11 and, using this on paper, we roll out two tooth-forms as shown in Fig. 12, one for each of the gears that are

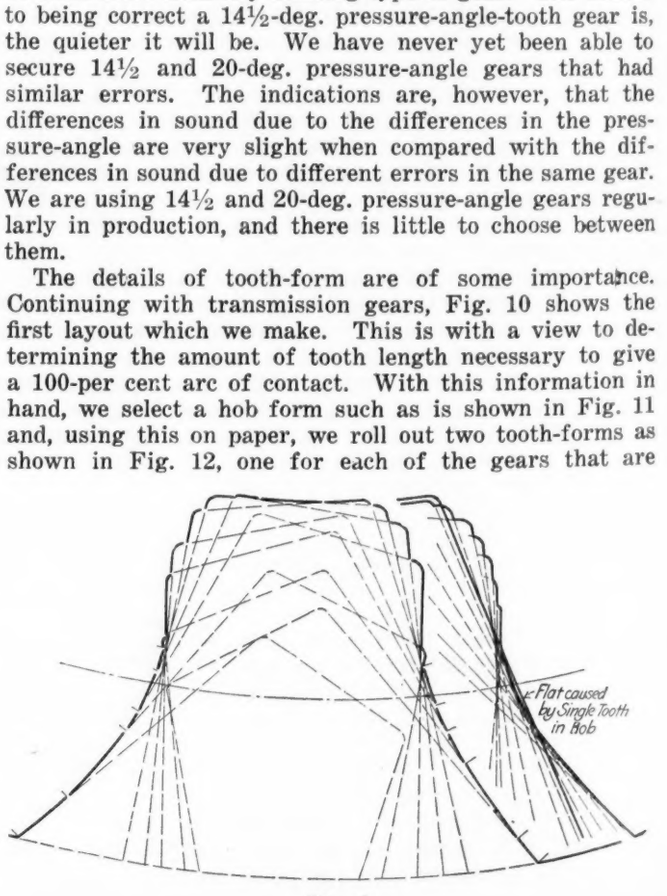


Fig. 9

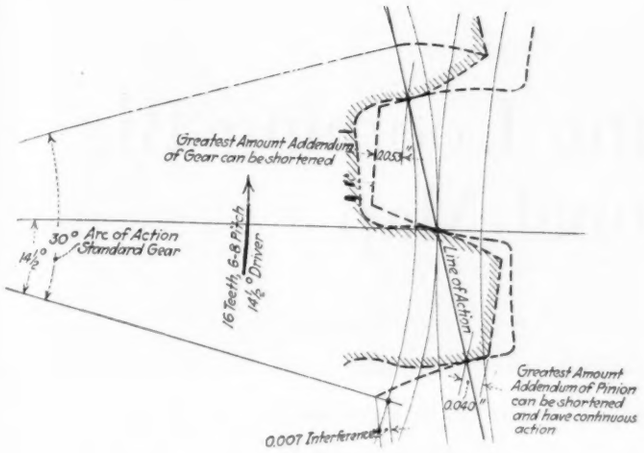

Greatest Amount Addendum of Gear can be shortened
.1035"
30° Arc of Action Standard Gear
14½°
16 Teeth 6-8 Pitch 14½° Driver
Line of Action
Greatest Amount Addendum of Pinion can be shortened and have continuous action
.040"
0.007 Interference

Fig. 10

intended to be in contact with each other. The next step is to roll these gears on each other to determine the interferences, if any, and the amount that they are topped-off; then, if necessary, the hob form is modified and the same procedure carried through. When the hob form is established on paper in this manner, it is charted as shown in Fig. 13 and the hob supplier is asked to conform to this shape. Definite tolerances are given for the amount of variation from this form. On receipt of the hob, we inspect this form on a hob-checking apparatus very similar to that which we use for checking gear-tooth forms, a drawing of which is shown in Fig. 14. If these conform to our standard requirement, it is expected that the hob will be satisfactory. We do not require any test of the hob in a cutting machine, because of the large number of errors that will be introduced by the machine, either in correcting hob errors or resulting in having an apparently correct hob rejected without cause.

We have prepared charts showing the condition of the gear in the green and the condition of the gear in the hard. These charts show such gears and the variations occurring in them. Similar variations occur in gears mating with these gears.

Freedom from warpage in steel is a matter of uniform hardening and cooling; also of removing all forging strains before machining. The question as to whether oil-treated steel is better than carburized is still unanswered as regards warpage. We have hardened more than 5000 gears of different brands of steel and carefully checked them. We find that there is very little difference in the warpage under the same hardening conditions.

THE necessity for grinding gear-tooth forms depends largely on our ability to cut and harden gears, maintaining definite shapes. However, there is a large difference in the number of rejections that we have from gears ground by different processes. Our reports show that out of 5000 gears ground by one method we have had a 14 per cent rejection. This is slightly greater than that which we have had from the hob gear without grinding. By another method of grinding of a similar number of gears, we have had less than a 0.5 per cent rejection, as well as more satisfactory gears. In the first case, four gears of the transmission were ground, and in the second case only two gears of the transmission were ground. All transmissions were passed by the same inspector and inspected to the same standards. We, of course, are looking forward with great interest to the continuation of our experiment on gear-grinding.

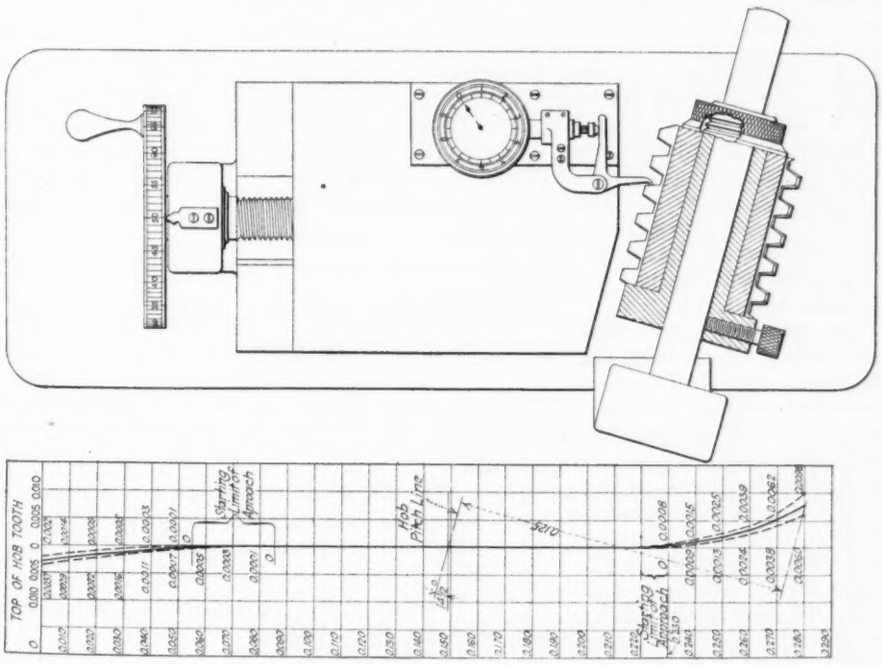
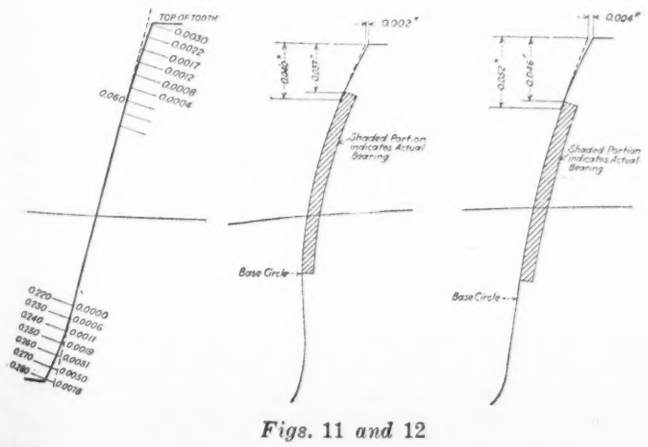


Fig. 13



Figs. 11 *and* 12

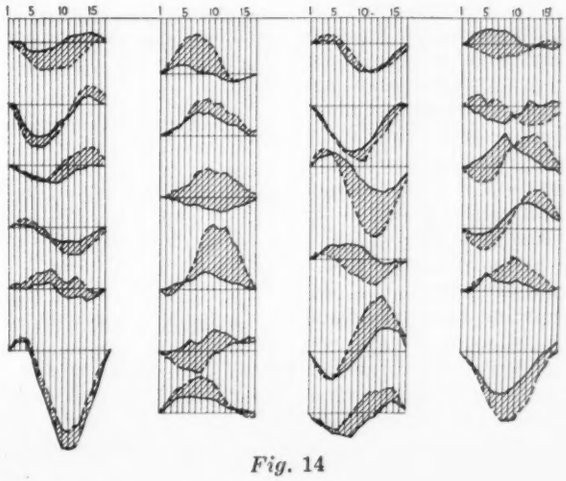


Fig. 14

Highway Engineering Looming Big on Educational Map

Fifty schools send representatives to Washington Conference. Long stride forward taken in unification of thought. Speakers lay down programs for training workers, construction and finance. Sociological phase viewed.

By James Dalton

HIGHWAY and highway transport engineering are now definitely on the educational map. Leaders in the field of technical training have given their approval to a definite program of instruction which looms large on the horizon. The colleges of the country will turn out each year larger and larger classes of young men qualified to take up the work of carrying forward the newest branch of the science of transportation.

The three-day conference arranged by the Highway Education Board, which ended Saturday at Washington, unquestionably was the most important meeting of its kind ever held in the United States. It brought together nearly 400 prominent educators, state highway officials, engineers, attaches of foreign embassies, Government officials and spokesmen for the automotive industry.

These thoughtful men discussed from every angle the vital problem of highway construction and maintenance, highway and highway transport engineering. They gave full recognition to the fact that a great system of improved roads, upon which stupendous sums are being spent each year, cannot be built and maintained properly unless the administrative work is in the hands of trained men. They realized also that with the rapid increase in the volume of highway transport, the day is near at hand when there must be an army of young men ready to direct it along sound and scientific lines.

Admitting these fundamental facts, it is apparent that the actual work of training must be done by the schools and colleges. That is the reason the heads of all the collegiate civil engineering departments in the country were invited to attend the Washington conference. It is significant of the interest in the subject that more than 50 of them accepted and attended every conference session.

One of the most important results of the conference is that most of the committees appointed to prepare reports on various phases of the broad subject, after frequent and earnest sessions, decided that the importance of the work they had undertaken was so great that they must give months of study to the problems involved before they could prepare final reports. For that reason those presented were merely preliminary in character, but even in that stage they evidenced marked progress.

This means that some of the best minds in the country will give careful consideration to subjects of fundamental import to the automotive industry. It is more or less sad but none the less true that educators and engineers appear to be more deeply interested in the construction of highways than are the men most vitally concerned—those engaged in the automotive industry. Makers of motor vehicles had few representatives at the conference but those who were there gave a mighty good account of themselves.

There was A. J. Brosseau, a recognized authority on the subject of highway finance whose paper on that subject was one of the big events of the conference; George M. Graham, the orator of the industry who delivered a brilliant address at the convention dinner, and C. C. Hanch who told the educators the market which awaits all the trained men they can turn out.

The class room and the assembly line of an automobile plant may seem far apart but they are not. Unless the class room can train the engineers needed to build highways and direct the transport over them, there will be no market for automobiles. A few of the far-seeing men of the industry sensed this fact long ago and they have worked tirelessly to make plain the relationship.

THESE addresses marked high spots on the program—

"The Highway Engineering and Highway Transport Fields and Their Need for Trained Men," by Thomas H. MacDonald and C. C. Hanch.

"The Trend of Education for Highway Engineering and Highway Transport," by T. R. Agg of Iowa State College, and Arthur H. Blanchard of the University of Michigan.

"Sending the Highways to School," by George M. Graham.

"Relation of Research to Highway Engineering and Highway Transport," by Dr. W. K. Hatt.

"Problems in Highway Finance," by A. J. Brosseau.

"Sociological Implications of Highway Transportation," by C. J. Galpin.

"Co-operation versus Competition Between Motor Truck and Railroad Transportation," by W. H. Lyford.

From left to right: Dean A. N. Johnson, College of Engineering, University of Maryland and president American Association of Engineers; Dr. John J. Tigert, U. S. Commissioner of Education, chairman Highway Education Board; Arthur H. Blanchard, professor of highway engineering and highway transport, University of Michigan; Thomas H. MacDonald, chief of United States Bureau of Public Roads

IT is evidence of the breadth of vision of these leaders of thought that they have taken a more advanced step than probably ever was taken before by the representatives of any great industry. They have placed all their cards on the table. They have laid down all the facts available for the analysis of experts and educators. They have agreed to abide by the decisions these men reach on the facts presented to them.

They are not asking special favors. They believe the industry they represent is vital to the life of the nation. They are convinced that the construction of an adequate system of improved highways is an absolute essential to progress. They are perfectly willing to leave to the experts the decisions as to how and where they should be built.

The highway problem has come at last to have a human as well as a technical side. The General Federation of Women's Clubs has taken it up. Some of its representatives sat through all the sessions and heard attentively the reading of even technical papers. They went to the banquet and listened interestedly to all the speeches as did a lot of other women. They realize that the building of highways has a direct bearing on the ability of city women to get better food at lower prices when new markets are opened to farmers and they know that the advent of the good highway will do more than anything else possibly can to lighten the drab life of the farmer's wife.

Sociological Aspect Grasped

THE sociological import of highway building has at last been grasped and it is a fascinating theme. Dr. C. J. Galpin, economist of the United States Department of Agriculture, told how good roads and motor vehicles are taking the city dweller from congested urban districts into the suburbs and are carrying some of the joys of life to the farm.

Looking at the subject from a purely selfish standpoint, truthful exploitation of what good roads and motor vehicles have done to brighten the family life of America, will do much to break down opposition to the expense involved in road building. It also will be a potent weapon with which to meet the insidious and selfish attacks of those interests which contend that motor vehicles should be taxed off the highways. Without them there would be no need for roads.

Many things of interest to the industry in addition to the long stride forward in relation to highway engineering education, came out of the conference. Dr. W. K. Hatt, director of the Advisory Board on Highway Research of the National Research Council, discussed "The Relation of Research to Highway Engineering and Highway Transport," and he brought out much which was of direct interest to automotive engineers. For example, he declared they should work in close co-operation with highway engineers in determining the effect of the various kinds of road surfaces on the vehicle itself. Another point was that there should be much more definite data on the effect of grades on fuel consumption.

Notwithstanding the profound effect on the industry of highways, there were present at the conference only two representatives of the Society of Automotive Engineers. It would seem that the industry should be in a position to direct research into these fields, in view of the fact that a large part of the expenses of the Highway Education Board are paid by the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers Association, the Rubber Association of America, and two or three far-sighted manufacturers who are deeply concerned about the future of highways.

Hatt's paper, taking up the most modern methods of road construction, was one of the most valuable read at the conference and was of deep interest both to the engineers and educators.

Trucks as Aids to Railroads

ANOTHER highly important contribution to the literature and research bearing on transportation, was the paper read by W. H. Lyford, vice-president of the Chicago & Eastern Illinois Railroad, on "Co-operation versus Competition Between Motor Truck and Railroad Transportation." It was characterized by J. R. Bibbins, of the Chamber of Commerce of the United States, as "meriting more serious study than any paper on the subject read in the last five years."

Lyford, who has made a close study of the terminal question, declared railroads should use trucks to supplement their service, especially in the collection and delivery of freight in congested centers. He also advised the abandonment of unprofitable branch railroad lines and the substitution of motor truck service unless local truckers are able to meet the needs of the population to be served. He was given a unanimous vote of thanks for the service he had rendered by the research which made the paper possible.

Thomas H. MacDonald, chief of the Bureau of Public Roads, to whom all State highway departments pay allegiance, declared that Lyford had presented for the first time in behalf of the railroads definite and tangible suggestions for the highway people to follow.

Expects Transportation Breakdown

ANOTHER highly important statement made by MacDonald in relation to the general transportation system of the country, voiced at an earlier session, was, in effect:

"The period of depression which followed 1920 gave highway interests a breathing space in which to accumulate finances and labor to rebuild the roads which had broken down under the unprecedentedly heavy traffic. Now, when they are needed again, they are in as good condition as ever with a greater mileage.

"Conditions similar to those of 1920, which have arisen again, have created a traffic congestion on the railroads which will throw a heavy burden on the highways, whether we will it or not. This condition will continue until a breakdown of the transportation system makes continued industrial progress impossible and then there will be another chance to rebuild and extend the highway system. This work, therefore, should be continued while there is still opportunity to carry it on."

MacDonald also pointed out that the war-time priority ruling against transportation of highway building materials on the railroads is again in effect although the dearth of rolling stock is again forcing traffic onto the highways.

When the concerted movement for the promotion of highway and highway transport engineering education began at the first conference only two years ago, even the handful of men who called it had only a nebulous idea of what they wanted to talk about although they realized dimly that they had a big problem. There were almost as many different ideas in relation to education, construction and finance as there were men at the conference.

Finance the Big Question

THE most striking difference last week was that almost all the 400 men at the meetings were thinking along the same general lines. While even the underlying problems couldn't be stated clearly at the first conference, a solution of some of the more pressing questions already is being reached.

One of the most significant indications that the minds of those most interested in the highway question are moving in the same direction is the rapidity with which an agreement in principle is being reached on that most troublesome question—finance.

Two years ago there was nothing remotely resembling agreement but when Brosseau read his carefully considered paper on that subject last week there were comparatively few who did not accept his contentions as sound.

Fundamentally, there was nothing new in Brosseau's arguments but they were unanswerable in the logic presented to support them. He declared that the public at large should pay the cost of building improved roads with long-term bond issues, except in states where too great a burden would thus be imposed upon taxpayers, and that the cost of maintenance should be paid by the users of the highways, principally motorists. He stressed the importance of maintenance and asserted that if the work was properly done roads would not break down.

The views of Brosseau are shared, in principle at least, by Chief MacDonald of the Bureau of Public Roads. He it is who guards the expenditure of funds appropriated under the Federal aid act. No man in the country has a broader vision of the highway system of the future and its importance to the nation. The motor vehicle looms large in the picture as he sees it.

Highway Education Promotion

THE work of promoting highway education is being carried on under the direction of Dr. John J. Tigert, the genial and human Kentuckian. who is United States Commissioner of Education. The other members of the Highway Education Board are:

Chief MacDonald, F. C. Boggs, Colonel, Corps of Engineers, U. S. Army, representing the War Department; Roy D. Chapin, representing the National Automobile Chamber of Commerce; Harvey S. Firestone, representing the Rubber Association of America; F. L. Bishop, Dean, School of Engineering, University of Pittsburgh, representing the Society for the Promotion of Engineering Education; H. W. Alden, representing the Society of Automotive Engineers, and Walton C. John, secretary.

The comprehensive character of the work undertaken is shown by the list of committees and the thoroughness with which it will be done is attested by the chairmen. The list follows:

Required and Elective Undergraduate Subjects in Highway Engineering.
Chairman: H. Walter Leavitt; Associate Professor of Highway Engineering, University of Maine, Orono, Me.
Required and Elective Undergraduate Subjects for Highway Transport Business and Engineering Positions.
Chairman: L. W. McIntyre; Assistant Professor of Civil Engineering, University of Pittsburgh, Pittsburgh, Pa.
Subject Matter of Basic Required Undergraduate Course in Highway Engineering.
Chairman: L. E. Conrad; Professor of Civil Engineering, Kansas State Agricultural College, Manhattan, Kansas.
Subject Matter of Basic Undergraduate Course in Highway Transport.
Chairman: C. B. Breed; Professor of Railway and Highway Engineering, Massachusetts Institute of Technology, Cambridge, Mass.
Subject Matter of Undergraduate Course in Highway Engineering Theory and Design.
Chairman: C. C. Wiley, Assistant Professor of Highway Engineering, University of Illinois, Urbana, Ill.
Subject Matter of Undergraduate Course in Highway Engineering Laboratory.
Chairman: C. A. Baughman; Professor of Highway Engineering, Alabama Polytechnic Institute, Auburn, Ala.
Nature and Content of Supporting Non-Technical Courses in Economics and English.
Chairman: Dr. Charles S. Howe; President, Case School of Applied Science, Cleveland, Ohio.
Graduate Work in Highway Engineering and Highway Transport.
Chairman: H. C. Smith; Assistant Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.
Conferences or Short Courses on Highway Engineering and Highway Transport.
Chairman: C. C. Albright; Professor of Railway Civil Engineering, Purdue University, Lafayette, Ind.
Teaching Highway Traffic Regulation and Safety.
Chairman: C. J. Hughes, Dean, Harvard Engineering School, Harvard University, Cambridge, Mass.
Sociological Aspects of Highway Transportation.
Chairman: Dr. C. J. Galpin, Economist in charge of Farm Population and Rural Life, U. S. Department of Agriculture, Washington, D. C.

Some of Colleges Represented

HERE are some of the State universities which were represented by the heads of their engineering faculties: Tennessee, Pennsylvania, Michigan, North Carolina, Oklahoma, South Dakota, Ohio, Colorado, Southern California, Minnesota, Missouri, Nebraska, West Virginia, Virginia, Georgia, Vermont, Maine, Rhode Island and Illinois.

Other colleges and universities represented were: Virginia Military Institute, Alabama Polytechnic, Virginia Polytechnic, Massachusetts Institute of Technology, New York University, Johns Hopkins, Rensselaer Polytechnic, Kansas State Agricultural, Cornell, George Washington, Catholic, Howard, Case School of Applied Science, Harvard, University of Pittsburgh, Lehigh, Drexel Institute, Columbia, Cincinnati, American, Carnegie Institute of Technology, Dunwoody Institute, Lafayette, Syracuse, Yale, Tufts, Pennsylvania State and Norwich.

State highway engineering departments represented included: Delaware, Connecticut, West Virginia, Nevada, Maryland, Nebraska and Illinois.

Most Important Task Is Awakening of Public To Need of Highways

Tigert and MacDonald warn of hard work ahead. Hanch tells of jobs awaiting trained men in engineering, transport and automotive field.

THE real keynote of the conference was sounded by John T. Tigert, United States Commissioner of Education and chairman of the Highway Education Board, at the opening session when he declared that the most important task ahead is to awaken the public to a realization of the importance of highway transport.

This point was emphasized by Thomas H. MacDonald, chief of the Bureau of Public Roads. He added that it was bound up inextricably with the need for educating the public to the proper use of highways from a traffic standpoint.

A very large part of the population of the United States will be reached by the proposed system of Federal aid roads, MacDonald said, and the highways will carry most of the highway traffic of the nation. He explained that it would take at least ten years to complete this great system aggregating 180,000 miles, and that when it is finished it will be necessary to begin immediately a rebuilding program.

There will be a tremendous need for highway engineers to build these roads and for highway transport engineers after they are laid down. He estimated that from $30,000,000 to $60,000,000 a year must be spent in administrative work in the expenditure of from $300,000,000 to $600,000,000 for road building.

Development of serviceable highways is not keeping pace with demand, MacDonald declared. The increase in the use of motor vehicles is the best index of the need for more roads, he added.

There will be opportunities for trained men in a dozen different fields, he said. Traffic engineering will absorb many of them in the future with the growth of highway transport. These men must have technical education and they must be developed along sound lines. The specialized training should be given as graduate work after a general foundation has been secured. Employment will be offered to those who are technically qualified.

Engineers in Public Service

DURING periods of industrial activity highly trained men are drafted in large numbers from public service. These men are secured by inducements of greater compensation and promise of continuity of employment. When an industrial depression sets in there is a drift of engineers to public service, but it is not as a rule the best trained men that public service secures in this manner. This, Mr. MacDonald says, is an indictment of the attitude toward public service.

A repetition of this cycle may be expected as industrial activity increases, he said. The degree to which these engineers remain in public service will be measured by the efficiency with which public funds are handled.

He urged the conference to concern itself with education in its broadest meaning and strive to awaken the public to a consciousness of the duties of public service. The public, he said, must be educated to the proper use of highways from the traffic standpoint.

The use of the motor vehicle has grown until it is now a major unit in transportation, requiring minds with varied training; but that in this step, which concerns itself with research in a variety of fields, the automotive industry is in a pioneer stage, was the contention of C. C. Hanch, vice-president of the National Automobile Chamber of Commerce and vice-president of the Lexington Motor Co.

He maintains that the industry will progress slowly or rapidly in this respect according to the degree that educators recognize the magnitude of the educational need involved, and the degree to which the industry and the universities make common cause.

The field of opportunity, he said, may be outlined as follows: Those within the manufacturing plants themselves and those in the extension of motor transport.

"The first class offers a field of opportunity in five distinct divisions. Research and design are the first of these. It affords a limited field in every factory where the services of a chief engineer and assistants will be required at salaries on a parity or higher than those of similar employment in other large manufacturing industries.

Problems to Be Solved

"AMONG the problems with which men of this type will have to deal may be enumerated the following:

"Development of strong, light metals, also steels and alloys, with high tensile strength.

"Designing of carbureters which will reduce fuel consumption.

"Improvement of braking and spring facilities.

"Building of a simpler transmission.

"Advance in headlighting system which will obviate glare.

"Simplification of construction.

"Development of equivalents for existing materials.

"Fabricated production is the second phase. Here, again, the field is limited, but obtains in every factory. The chief problems involve questions of serial and mass production. The men in charge must be equipped to bring about modifications in factory practice to meet with changing requirements of design and to effect economies in production. The educational requirement is a study in engineering.

"Purchasing is another field which is common to all factories and requires the services of at least one highly paid man and assistants, whose salaries will depend upon the size of the factory. These men should be thoroughly grounded in business practice, and preferably, should have an engineering knowledge of the materials which they buy. They must also have an understanding of economic trends.

"Sale and extension work is one of the largest fields of employment in the salaried field in the industry. Compensation there, as in all sales fields, depends directly upon the ability of the man. In general, the applicant should

know the principles of psychology, business practise and economics.

"The fifth and last field is a specialized one—the highway transport engineer. This man should be both an engineer and an economist. He is, in fact, a glorified salesman, who must be able to map out selling campaigns on a mass scale dependent upon the growing field of highway transport; as, for example, in the use of the motor bus in connection with consolidated schools, the use of passenger fleets for traveling salesmen, etc. This field is limited, but again the compensation is in proportion."

SPEAKING of the second large class of employment, he defined it as having to do with the operation of the vehicle in the field as a phase of highway transport and with the extension of sales promotional effort by the dealer. He said:

"Highway transport, as such, offers employment for a large and growing group of fleet owners, superintendents, dispatchers and operators. The colleges are generally concerned only with the first two classes. Education for these fields should include a general knowledge of economics, business practice and sufficient engineering to enable the man to build and conduct service stations, etc. This field offers attractive remuneration for the owner and a few very high salaries for the superintendents, depending upon the size of the fleet."

In emphasizing the importance of the dealer, he said:

"He is the pivotal point in the future of the industry. His is the immediate contact with the public. He should have a general training in business practice, economics and psychology. He must be a leader. The field is very large and the reward in proportion. If he is selling motor trucks then he should have some grounding in engineering."

He pointed out that "beyond these fields and as a direct offspring of the motor industry, there are the allied fields of the city planning commission, the traffic engineer and the transportation expert of the state highway department. These fields come under the head largely of public service. They will require many men of vision, with a thorough grounding in economics, sociology and engineering."

Urging that the aspect of national defense should be considered in the highway educational program, Major General Lansing H. Beach, chief of engineers, U. S. A. War Department, stated that his department was heartily in accord with all highway development movements and vitally interested in the work of the Bureau of Roads. He contended that commercial highways should follow as closely as possible military needs, for these highways must be built before the emergency arises.

SINCE educated men are needed badly in highway and highway transport development, effort must be concentrated on finding the men and giving them the necessary training, Dr. C. F. Scott, president of the Society for the Promotion of Engineering Education, urged that the conference state just what it wanted in the way of trained men, how many men it could use in this field and allied fields and when they wanted them, immediately or five or ten years from now. He questioned whether the highway field wants men who will produce in a measure immediately or men who will mature in the broadest degree in, say, twenty years.

The supply of trained men furnished by the engineering schools for highway work will depend on the demand for these men, Dr. Scott said. If the field of highway engineering will give the men the opportunity for development, then the field will get them. Growth, he said, depends on experience, and in order to get men to enter this field they must be assured that they will get experience. Leadership comes from development, and the chance to develop must be given if the right sort of men are to become interested and attracted toward this field.

True leadership, he said, is the spirit of service.

Suggested College Course in Highway Transport

THAT it is not advisable to give a four year college course leading to a degree in highway transport, was the decision of the committee headed by Prof. C. R. Breed of the Massachusetts Institute of Technology, to consider the subject matter of a basic undergraduate course in highway transport. It was held, however, that instruction in highway transport should be required under certain circumstances and offered as an elective in others. It was further decided that a course in highway transport should constitute a part of the undergraduate curriculum in those schools in which students are trained for highway engineering. The following outline for a highway transport course was suggested:

General Introduction.
- Classification and Natural Functions of Different Agencies.
- Interrelation of Railways, Highway and Waterways.
- Public's Interest.
- Individual's Interest.

Service to be Performed.
- Commodities adapted to Motor Transport.
- Economic Length of Haul for Different Commodities.
- Quick and Dependable Delivery.

Highway Transport Surveys
- Road Condition Survey—Structures—Pavements.
- Traffic Survey.
- Industrial Survey.
- Competing Transportation Agencies.

Classification of Equipment.
- Passenger Cars—Buses.
- Trucks—Tractors—Trailers.
  - Choice of Body.
  - Proper Type and Size of Truck.
  - Capacity Ratings.

Operation.
- Management.
- Routine—Dispatching.
- Fleets.
- Pay Load — Dead Load — Return Load.
- Inspection and Repairs.
- Selling Transportation.

Costs
- Fixed Expenses.
  - Taxes—Insurance—Interest—License.
  - Supervision—Overhead.
  - Depreciation.
- Variable Expenses.
  - Maintenance.
  - Operating.
- Same Items Often Under Both Fixed and Variable Expenses.
- National Standard Truck Cost Keeping System.

Freight Classification and Rates.
- Prevailing Railroad Rates.
- Perishable and Non-Perishable Goods.
- Raw and Manufactured Products.
- Total Comparative Costs Door to Door by Different Available Transportation Agencies.

Regulations.
- State Laws.
- Truck as Common Carrier.
- Municipal Regulations.
- Taxes—Licenses.
- Size and Weight Restrictions.

Pay for Highways With Long Term Bonds But Keep Them in Repair, Brosseau Advises

Declares in highly important paper on road financing that maintenance is equally as important as construction. Plan for financing.

"PROBLEMS IN HIGHWAY FINANCE" were discussed by A. J. Brosseau, president of Mack Trucks, Inc., who is regarded as the authority of the industry on this particular phase of highway building. His paper was regarded as one of the most important on this subject ever presented, for it dealt with the latest trends of thought in relation to the financing of highways.

The contention of the enemies of improved roads, and those who are lukewarm to their construction, has been that they should be built on a "pay as you go" basis and that they should not be a "burden" on future generations.

"We are proposing," he said, "that this generation shall undertake to build these roads, charge the cost to capital account, pay for them by long term bonds, use them and pass them on to the next generation in as good or better condition than when we built them. We propose that each generation shall pay a fair rental charge for the use of these roads in the sum of amortization charges, and interest, plus maintenance. Shall we not, then, proceed as would a business man, or a farmer, when setting up his establishment? The full cost of the factory or the farm would not be assessed against the first year's income, but would be carried over a term of years, during which time the returns would be enough to meet all charges and a pay profit as well."

OUTLINING what he considered an ideal program of highway finance, Brosseau laid down these points:

"First—The preparation of a construction budget by every state, estimating the cost of the primary and secondary roads to be built, year by year, for the next ten years.

"Second—That, based upon the stage of development of that program at this time, the cost of construction—all or part—shall be met by bond issues, except those states where the construction program is practically complete.

"Third—That a budget of current operating costs be set up to defray interest on bonds, amortization charges and maintenance. The amount necessary to pay interest and amortization should be included in the general tax levy. The cost of maintenance should be assessed against the user.

"Fourth—That all expenditures should be under the control of the state highway departments.

"Fifth—That regulatory powers should be as flexible as possible and lodged only within the state highway department, to be administered in accordance with the needs of the public."

As a summary for consideration where state highway bond issues are necessary, he proposed that:

"First—Bond issues should be serial in form and issued for as long a period as fifty years. The fund should be expended under rigid engineering control and provision must be made for sufficient current income to pay interest, amortization charges and adequate maintenance.

"Second—Interest on bonds and amortization should be paid for from general taxation. Maintenance costs should be charged against traffic.

"Third—Maintenance should include all charges up to and including construction save where an inferior is replaced by a superior type of surface.

"Fourth—Only that type of road shall be constructed which is adequate for the needs of the present and future traffic. This shall be determined by careful surveys both of traffic and economic possibilities."

"A SURVEY of highway development as it is to-day shows that we are annually appropriating sums aggregating more than $1,000,000,000 for city and rural highway construction and maintenance. A further survey of our needs shows that this program must be continued for ten years or more if we are to arrive at a connected system of highways which will render the greatest possible service to the public.

"If we were dealing with this question in the untroubled days before the World War, the matter of finance would be a relatively easy one and we would not be so much concerned with ways and means. But it is necessary to remember that to-day the nation is carrying a heavy tax budget, and, what is more important, that the state and county levies are at higher levels than they have been in the past. Accordingly, we must weigh well all of the elements entering into any appropriation for any purpose, and only those must be made which we know will surely return a direct profit to the public. Further, we must seek to definitely allocate those profits so that the burden will be borne in as large a measure as possible by those who are the beneficiaries.

"Broadly speaking, we will all agree that those who are alive to-day and those who come after them down to the children of the third and fourth generations, will benefit from highway construction, provided that, once constructed, the highway is maintained. Some might go further and say that the highway, if maintained, will be of benefit for all time, but looking at this as practical men, we can concern ourselves only with a definite period of time wherein the inventive genius of the country would not have opportunity to upset our present scheme of transportation by new methods. This might well be from fifty to one hundred years.

"IT would then appear as a general proposition, assuming the ability of our engineers to maintain a highway once built, that the cost of highway construction should first of all be divided between this generation and those to come, which, of course, at once implies long term highway bond issues.

"Here again, however, we come at once to practical limitations, the extent of which must be finally determined by economic research.

"Can the highway engineer maintain the road once built?

"We have been accustomed to hear that roads have

From left to right: C. C. Hanch, vice-president of National Automobile Chamber of Commerce; D. C. Fenner, of Mack Trucks, Inc.; M. B. Leahey, general sales manager, Durant Motors, Inc.; Ezra W. Clark, advertising manager, Clark Equipment Co., Buchanan, Mich.

broken down under heavy motor traffic and that money expended for them has been wasted. Is this true? Fortunately, in this field we appear to be arriving at a definite demonstration of facts. Engineers tell us, for example, that 40 to 50 per cent of the cost of construction of a highway is permanent, assuming that the highway has been properly located. The right of way, the grade, the drainage, bridges, shoulders and engineering costs need only be paid for once. It is the surface which wears.

"Engineering records show that here the loss is less than is popularly supposed, since in the rebuilding of a surface it is possible to salvage much of the material and use it for a base for new surfacing.

"This leaves us with a definite need for constant maintenance and that maintenance is limited not by physical but by financial ability. We have placed too much stress upon the original construction and not enough upon the constant maintenance.

"Can we assume proper location of the highway? Here again is a field for the student of political administration in its relation to economics. The state engineer, looking at a map which shows the economic development of a state, the routes of through travel, and the feeder lines, has before him a bird's-eye picture which enables him to determine positively and accurately where highways should go. We cannot expect the local official to be able to gage this so well. Centralization of authority seems essential if the public's funds are to be properly conserved.

"SHOULD we seek to develop all highway construction through bond issues?

"This question is one which cannot be fully answered until those preceding it are taken into account. Before we expend any funds we must know that the benefits to be derived from the improvements of a highway are more than sufficient to justify the cost of that improvement.

"We must then be sure when bond issues are proposed that the improvement promises something more than the cost of maintenance.

"Before granting the authority to issue bonds, provision must be made for the proper control of construction expenditures, adequate maintenance and sinking funds.

"These points checked off, we are likely to find that we have come down to a consideration of the improvement of the main state systems, which will average about 7 per cent of the total mileage of this country. When completed, this system will place all of us on main roads, or but a few miles away, and through the feeder lines we will be enabled to reach the great highway and deliver our commodities to market.

"Here, then, is the field in which the cost of highway construction should be divided between this generation and those to come. We are proposing that this generation shall undertake to build these roads, charge the cost to capital account, pay for them by long term bonds, use them and pass them on to the next generation in as good or better condition than when we built them. We propose that each generation shall pay a fair rental charge for the use of these roads in the sum of amortization charges, and interest, plus maintenance.

"SHALL we not then proceed as would a business man, or a farmer, when setting up his establishment? The full cost of the factory or the farm would not be assessed against the first year's income, but would be carried over a term of years, during which time the returns would be enough to meet all charges and pay a profit.

"This must not be taken to mean, however, that we should at once proceed arbitrarily to say to every state: You must have a bond issue to take care of your road improvement program. As in all other phases of this complex problem, there are a host of limitations to be set up, and it is only through investigations by trained men that we shall ultimately find the correct answer. Dogmatic statements must be avoided. Prejudice must be eliminated.

"Analyses of highway development to date show that there are two general sets of conditions which apply. The first is found in those states which, like New York, Massachusetts, and some of the other Eastern and perhaps Middle Western sections, have to deal with a developed traffic problem and have already met with many of the conditions mentioned.

"THE other condition is that of the Southern or Western States, where valuations are low, mileage is high and traffic not yet developed. Here the problem is one of construction, largely. The general tax burden is high, and any attempt to meet the needs of highway development from current funds would result in so retarding the program that dollars would be lost in diminished or retarded economic development where pennies would be saved.

"The question which here must be answered is: 'Do the increased profits resulting from highway construction under bond issues offset the difference in cost as between "pay-as-you-use" and "pay-as-you-go" methods of financing?'

"Looking at this from the viewpoint of the business man suggesting clues to be run down, I want to state at the outset that if you consider this problem from the standpoint of building, let us say 100 miles on a pay-as-you-go policy in ten years' time as against 100 miles in one year with a bond issue, in the first case, in ten years you will have paid all of the principal charges of that 100-mile construction, but will have obtained only an

average use of fifty miles for the entire ten-year period, while 100 miles built in one year give the use of the entire mileage.

"THIS immediately suggests again the question of the benefit to be derived. In either case it must be assumed that there is to be a benefit, or the program should not be undertaken. The difference, then, is the interest charged. Against that there is the ten-year use of the 100 miles, and engineering investigations now under way indicate that the difference in operating costs of transport alone over the good road as against the bad would be sufficient to defray the interest charges many times over, even if we discarded the social benefits which inure.

"Thus far we have discussed as beneficiaries only two general classes: this generation and those that follow.

"If the highway bond issue plan is to be carried out, however, we must set up the conditions under which these bonds will be issued, and in order to do so we should determine more specifically the question of beneficiaries in order that, in setting up our source of revenue, we shall be as equitable as possible.

"At once a new set of questions presents itself for examination.

"What is the effect of highway improvement upon agricultural valuations?

"What is the effect of highway improvement upon urban valuations?

"What is the effect of highway improvement upon the operating costs of the user, the agent of the public?

"The answers will vary according to the topographical conditions, the economic conditions, the extent and character of the traffic. Each state will have to meet this situation as its own needs demand, and these needs can only be finally determined by specific inquiry and investigation upon a very broad scale.

"THERE are few to-day, however, who will deny the influence of highway development upon the farmer. The truck gardener, the dairy products man, and even the producer of heavy staples, has found his markets favorably affected by highway improvement. Perhaps more important, the educational and social advantages derived from highway extension have opened a new vista to all.

"Likewise, the development of urban properties, and particularly of suburban properties, has been perceptibly affected. No one who drives a motor vehicle or a horse will question the beneficial effect of highway improvements.

"How far the use of large units made possible by road improvement has affected the economics of all three groups mentioned, is a point which few can discuss fully yet, particularly with regard to road improvement costs, but here again there is a definite problem to be worked out.

"So that while the relative amounts may differ, it seems that any fair plan for construction should be based upon general taxes for construction purposes, since all classes are enumerated in the three broad divisions mentioned.

"When maintenance is considered, however, a different answer presents itself. The damage to the wearing surface is done by traffic. Traffic benefits first by maintenance in lowered operating costs, so traffic should be expected to meet this levy.

"YET at once the question arises as to what is maintenance? Shall we say that a manufacturer building a new plant or installing new machinery to take care of increased business should consider *that* an item of current expense? Could the farmer or business man who attempted to assess such costs against his crop or output in a single year, expect the buyer to pay it cheerfully? Likewise would the extension of a highway or its widening be an item in maintenance or construction? There seems to be a close parallel in these two instances, and undoubtedly where cases of this kind occur, ordinary business practice will prevail.

"The same problem presents itself when a road is lifted from a low to a higher type to the extent of the difference in cost.

"Another consideration which must be made a matter for thorough study is found in regulation of traffic on the highways. The whole question of finance is tied up in this point, because, after all, the only justification for any highway improvement, as I have already noted, is the service which the highway renders, and that service should be permitted to grow without restraint as long as it is sound economically.

"IF we restrict traffic unwisely, maintenance costs may be less, but transport operating costs may be swelled out of all proportion, and since the public pays the bill in any case, we should seek to make highway transport in its entirety function at the lowest possible cost.

"Here we can suggest a prolific field for investigation. Overloading apparently damages both road and vehicle. Seasonal limitations appear to be necessary under certain conditions, and still with a railroad congestion such as obtains to-day, *which* is of the greater public moment—the maintenance of a low grade highway surface, or its destruction by goods which must be moved? There should be definite restrictions on maximum loads, of course, at least until the highway builder can catch up with the highway user—a goal still far in the future—but it is not necessary to consider that phase in detail now.

"I only wish to point out that unwise regulation, just as abuse of the road by the user, may operate to the detriment of the public interest, and therefore both should be carefully guarded against, particularly where we are concerned with the general aspects of a broad financial program predicated upon the need for traffic development."

AN animated discussion followed the reading of the paper. Chief MacDonald of the Bureau of Public Roads, who presided, said there was a feeling that motor trucks should pay for damage done the highways, but he pointed out that the streets were filled with taxicabs, and that even if they don't wear out the pavements the roadways have to be made wider to carry them and other passenger carrying vehicles. It was his contention that trucks require depth in highway construction and that passenger vehicles require width. Such being the case, he held that it was not fair to impose the major part of the burden on trucks.

From left to right: Lewis W. McIntyre, assistant professor of civil engineering, University of Pittsburgh; Dr. Charles S. Howe, president of Case School of Applied Science, Cleveland

Railroads Should Use Trucks to Supplement Service, Lyford Avers

Vice-president of Chicago & Eastern advises freight cartage in congested centers and abandonment of unprofitable branch lines.

"UNLESS there is a radical change from present practices in railway transportation in the United States our great system, which is the wonder of the world, will become a hindrance to the further progressive development of this country."

This was the rather startling statement made to the conference by W. H. Lyford, vice-president of the Chicago & Eastern Illinois Railway, in a paper on "Co-operation versus Competition Between Motor Truck and Railroad Transportation." He took up only the handling of freight and did not discuss passenger traffic. He is firmly convinced that the carriers should use the motor truck to supplement the service now given. One of his proposals was that the railroads should offer shippers a cartage service, at fixed tariffs, which would transport goods from the point of origin to the car and from the car to their destination.

Lyford would have this system apply not only to less than carload but to carload lots. It would obviate the necessity of huge terminal and storage facilities and would insure prompt loading and unloading of rolling stock.

He believes another field for the profitable use of the motor truck by the railroad is between communities which are served by branch lines of railway on which the traffic is too light to pay the expense of any kind of railway transportation. Such branches are innumerable, he said, and it is his belief that they should be abandoned. A less expensive truck service should be provided if the trucker will not occupy the field.

Lyford said in part:

"THE fields within which complete transportation of goods can be furnished by highway alone or by railway alone are limited.

"There are very few industries or residences in continental United States which are not connected with each other by highway and it is physically possible to perform complete transportation of goods by highway, between almost any two industries or residences. But such transportation is most economical only when limited to the movement of goods between homes or industries which are within reasonable trucking distance from each other.

"The determination of such reasonable distance depends on many conditions and a competent truck expert will place it anywhere between 25 and 150 miles. Of course there are emergencies and peculiar industrial conditions which, in rare cases, make trucking economical over a distance of several hundred miles, but such cases are negligible in the consideration of the whole field of highway transportation.

"On the other hand, comparatively few industries and practically no residences are connected with each other by railway. Therefore the field for complete transportation of goods by railway is restricted to the movement of carload freight between those industries which have direct rail connections. In that limited field the railway is the most economical means of transportation. A fair example is the movement of coal from a mine to an industry located on a side track.

"In this country, four different agencies are competting with each other for the transportation of the same goods: parcel post, the express company, the railway and the trucker.

"Competition for the local carriage of goods within city and suburban areas ought to be welcomed by the railways, as they perform this service at an actual loss, while the trucker can perform it at a profit. On the other hand, competition with the railway for the carriage of goods through rural districts, along main lines of railway, is harmful to the railway and unprofitable to the trucker.

"FOR parcel post there is complete co-operation between railway and highway transportation, as the government has its own cartage system. There is like co-operation in the express business, as the express company operates its own trucks and wagons. For freight traffic, there is hardly any co-operation between the railway and the motor truck.

"I have marshalled the foregoing facts, without any idea that they would be new to you but that they might form a background for the statement:

"That unless there is a radical change from present practices in railway transportation in the United States, our great transportation system, which is the wonder of the world, will become a hindrance to the further progressive development of this country.

"Five years ago, when our railway system was placed under Federal control, its march of progress was halted and it has never regained its stride. Its development has not kept pace with the industrial development of the country, because its revenues have not been sufficient to attract the additional capital necessary to finance the cost of normal additions and betterments to road and equipment.

"The public is clamoring for lower rates, while existing rates are not high enough to produce the net railway operating income which, as determined by the Interstate Commerce Commission, the railways are entitled to earn. Still the tendency of the Commission is to reduce rates and there is no reasonable hope of increasing them.

"I have arrived at the definite conclusion that the problem can be solved only by remedying the following evils:

"First—Too low compensation paid to the railways for carrying parcel post and express on expensive passenger trains.

"Second—Lack of organized collection and delivery service, which lack makes it necessary to furnish unreasonably large and expensive freight terminal facilities, and an unreasonably large supply of freight cars.

"Third—The use of box cars for the transfer of l.c.l. freight between railway stations in large terminal areas. The trucker could perform that necessary service more quickly and economically. Thousands of box cars thereby would be released from an unprofitable service and would increase the carrying capacity of the railway.

"Fourth—The use of box cars as trap cars, for moving l.c.l. freight through terminal areas for industries which have rail connections, and the iniquitous absorption by the railways of trap-car, subway and lighterage expenses, which is equivalent to furnishing free cartage to the favored few large traders, in discrimination against the average trader, who is obliged to provide or pay for his own cartage.

"Fifth—The operation of branch lines on which the traffic is too light to sustain railway transportation and which could be served better and at far less expense by the motor truck.

"THE most important field for co-operation between the railway and the truck is offered by collection and delivery of l.c.l. freight in large cities. Comparatively few trucks are used in this service, first, because there is no co-operation between the truckers themselves, and second, because there is no co-operation between the trucker and the railway. As the collection and delivery of l.c.l. freight in large cities is now conducted, the delays to trucks in reaching the station door and in loading and unloading the truck, make unprofitable the use of the truck in station service, so that by far the greater part of this service is performed by horse-drawn vehicles. Truck transportation is only profitable when the truck can be kept moving the greater part of the time.

"Notable experiments have been tried in the United States for handling the collection and delivery of the freight of one railway company in a large city and, so far as I have been able to learn, none of them have been successful. No single railway company receives and delivers freight from and to every part of a large city in sufficient volume to make profitable the collection and delivery of such freight by a trucking organization. I am satisfied, however, that the combined l.c.l. freight of all the railways reaching a city could be collected and delivered by a properly equipped single trucking organization, working in full co-operation with the railways, at less cost than is now paid by the traders in that city for their cartage, and still yield a reasonable profit to the trucking organization.

"I am well aware that the average railway manager in this country fears to encourage the establishment of collection and delivery service because of the danger that the railway will be required to pay the cost of the service and thereby increase the terminal expenses. I would not recommend that the collection and delivery service be forced upon the trader, but rather, that it be offered to him under separate cartage tariffs at rates which would be less than the trader's present cartage expenses.

"THERE is a second field for co-operation between the motor truck and the railway, which would require a more radical departure from present methods than the one just mentioned, but which would produce even more beneficial results to all parties concerned. It is the organized delivery of carload freight from public team tracks in large terminal areas.

"As already stated, this freight is now loaded, unloaded, collected and delivered by the trader, or at his expense. In different cities the trade is allowed from 2 to 5 days within which to unload cars after he has received notice that they are ready to be unloaded.

"Competition between the railways to outdo each other in affording privileges to the traders has brought about a situation which is crippling the freight car supply and thereby is injuring the trader more than he is benefited by the allowance of an unreasonable time within which to load and unload carload freight.

"At the present time there is a serious shortage of freight car equipment in all parts of the country. The railways, the commercial organizations and public authorities are urging the traders everywhere promptly to load and unload cars in order to reduce the idle time of freight cars and supply the crying need for more cars to move accumulated freight. Notwithstanding these appeals, the car shortage is not being substantially remedied.

"In my judgment, a new system of delivering carload freight must be adopted and it will require the co-operation, not only of the railways and the truckers, but also of the traders, warehousemen, the Interstate Commerce Commission and the State Utilities Commissions.

"I REALIZE that this is a radical change and would deprive the trader of a substantial amount of free storage which he has always enjoyed and would require him to pay warehouse charges on such inbound freight as he is unable to receive on the day of its arrival. This apparent disadvantage, however, could be, to some extent, offset by cheaper cartage furnished by an organized collection and delivery service and the warehouse charges might be reduced substantially by co-operation between the railway, the trucker and the warehouseman.

"Another field for the profitable use of the motor truck is the transportation of freight between communities which are served by branch lines of railway, on which the traffic is too light to pay the expenses of any kind of railway transportation. Such branches are almost innumerable and are scattered over every part of the country. They were built before motor transportation was perfected and, undoubtedly, they have performed a necessary public service, but they have outlived their usefulness.

"The transportation furnished over such branch lines could be performed better and more cheaply by motor conveyances over the public highways. No more such branch lines ought to be or will be constructed, if the trucker will take over the field and occupy it intelligently and efficiently. In recent years I have known of several cases where railways seriously have contemplated the construction of branch lines to reach small cities and towns and, on investigation, have found that they could better afford to establish their own truck service and the proposed branches have not been built.

"I will go further and state that I think that all such money-losing branch lines along which transportation by truck over existing highways could be furnished at less expense, should be abandoned. The better and less expensive truck service should be substituted by the railroad company if the trucker will not occupy the field.

"FIVE parties are interested in bringing about the changes we have outlined:

"The whole public would be benefited in that the city streets would be relieved from the congestion caused by wagons and trucks carrying small lots of freight to and from the railway stations. The new rural highways would last longer, as the co-operation of railway and truck would put an end to long-distance trucking.

"The trader would get better service at less cost.

"The motor-truck industry and existing cartage companies and private truckers who would co-operate with the railways would vastly increase their field for profitable operation.

"The warehousemen would profit by the addition of the storage now furnished by the railways.

"The railways would cut down their terminal expenses and would increase their capacity for service.

"The trucker has a distinct advantage over the rail-

way, in that highways are constructed by the general public, through some form of taxation, while the railway is constructed at the private expense of the railroad company.

"In the early history of this country public lands and moneys were contributed to a few railway companies to induce them to build railways in territory which greatly needed transportation, but such donations have long since been repaid by the enhancement in the value of the taxable property, whose development has followed the railroad and would not have occurred without the railroad.

"The railway, through taxation, pays a large share of the cost of constructing and maintaining highways, while the trucker pays no part of the cost of constructing or maintaining the railway. If the trucker is to compete with the railway, either he should pay a substantial part of the cost of constructing and maintaining the highway or the railway should be relieved of taxation for highway purposes.

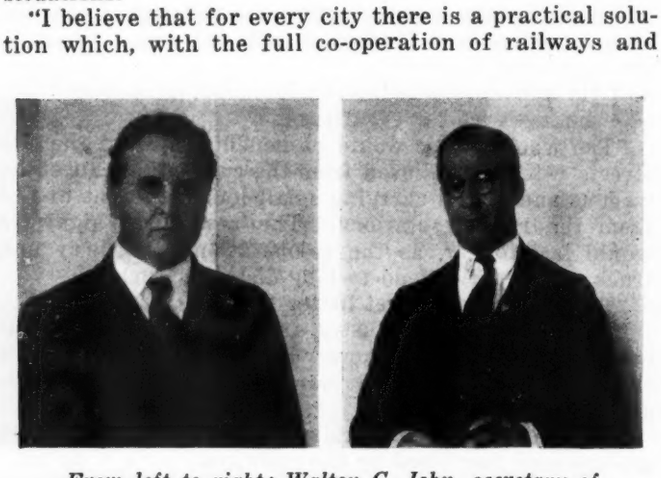
"If, however, the trucker, first, would perform that part of transportation furnished by the railway at an operating loss and on which the trucker could make a reasonable profit; second, would cease to compete with the railway for the traffic which the railway can carry at a profit and on which the profit of the trucker is very doubtful; and third, would co-operate with the railway in handling traffic which requires transportation both by rail and highway; in other words, if the truck would supplement the railway service instead of competing with it, then it would be to the interest of the railway that the expenses of the trucker should be reduced to the lowest possible limit, and, in my judgment, the railway could well afford to pay substantial taxes for highway purposes and to make no objection to the free use of the highway by the trucker.

"There is a steady and, for the trucker, an alarming growth of public sentiment in favor of imposing upon the trucker a more substantial part of the cost of maintaining and renewing public highways, which, it is claimed, are destroyed by heavy trucks almost as fast as the highways can be constructed. If the public were satisfied that the truck was only used as a common carrier where the railway could not furnish as good and as cheap service as the trucker furnishes, I believe the public would cease demanding that greater burdens be placed upon the trucker, which would increase the cost of his service.

"No single scheme of operation will fit all terminal situations.

"I believe that for every city there is a practical solution which, with the full co-operation of railways and trucks, would result in the movement of freight through the city stations as soon as it arrives there and would thus enable the railway to furnish much more transportation service without increasing its facilities and without increasing its charges for transportation.

"The truck should supplement the railway and not compete with it. Wherever complete transportation can be furnished by the truck more efficiently and cheaply than by the railway, the truck should be used. Wherever the railway service is adequate and profitable and less expensive than truck service, the railway should perform the service. Where the best and cheapest service can be furnished profitably by railroad and truck combined, the railway and the trucker should co-operate in furnishing that service. The railway and the truck should keep out of each other's special territory and less expensive service."



From left to right: Walton C. John, secretary of Highway Education Board; Dr. W. K. Hatt, director of Advisory Board on Highway Research of National Research Council.

Official Observers from Foreign Powers Gather Data to Promote Highway Building

OFFICIAL observers from several foreign governments were in attendance at the highway conference. It is expected that their reports and recommendations to the home governments will have a great influence on highway construction in their respective countries. Many of the foreign agents are civil engineers and have had some experience in constructing highways. The Latin-American countries were well represented at the meeting.

Just how this vital information affecting highways and highway transport is given to the dealers and car users in foreign countries is illustrated in the case of the Cuban government. Porfirio Bonet, Cuban Commercial Attache, is a practical civil engineer and will report his observances to the Cuban Minister in this country. The report will cover various phases of the meeting, especially plans for extending highway construction and motor transport.

Senor Bonet stated that the Cuban Minister would forward his report to the Secretaria de Obras Publicas, Havana. If the government believes the report worthy of publication it will be printed in pamphlets and circulated to automotive dealers and others interested in highway construction in Cuba. The technical angle of the conference here will be reported to the Division of Roads in the Department of Public Works in Havana, and to the Society of Civil Engineers which co-operates with the government in promoting highway construction.

Senor Bonet stated that he was wonderfully impressed with the development of American highways and motor transport systems during the last decade. He expects that the Cuban people will materially benefit from the progress of their American friends because American cars predominate the Cuban market.

Some of the foreign representatives at the conference were: Octavio Beeche, Minister of Costa Rica; Dr. Neumeister, Commercial Adviser to the German Consulate in New York; Arturo Padro, Charge d'Affaires a.i. Legation de Cuba; G. A. L. Dumont, Colonel, French General Staff Military Attache; Dr. A. Z. Stangler, Commercial Attache, Czechoslovak Legation; Axel Leonard Astrom, Envoy Extraordinary and Minister Plenipotentiary, Finland; Colonel Alessandro Gaidoni, Aerial Attache, Italian Embassy; A. W. Campbell, Chief Commissioner of Highways, The Dominion of Canada; Dr. Santiago F. Bedoya, Second Secretary of the Embassy, Peru; Edgar L. G. Prochnik, Charge d'Affaires of Austria, Austria; Dr. J. B. Hubrecht, Secretary of Legation and Charge d'Affaires, Netherlands.

Farmers and City Dwellers Benefit Equally From Use of Automobile

Graham paints vivid picture of increased happiness for all classes which has come with universal use of motor vehicle.

TWENTY-FIVE million automobile passengers daily, the movement of one billion and a quarter tons of freight annually by motor trucks, the expenditure of six hundred million dollars annually on highways, and an investment of one and one-half billions of dollars in automobile manufacturing plants, are a few of the achievements of the automobile industry within two decades, as charted by George M. Graham, vice-president of the Chandler Motor Car Co., at the conference dinner Thursday evening.

Mr. Graham, long hailed as the "silver tongued orator" of the automotive industry, made one of the most brilliant addresses of his career.

The address, made before 300 engineering and highway transport educators, State highway engineers, Federal officials and manufacturers assembled from all sections of the country, pointed out the vital necessity for further education of public, State and Federal officials, and outlined in detail the financial, economic and sociological advantages of motor transportation.

He was introduced by Dr. John J. Tigert, U. S. Commissioner of Education, who is also chairman of the Highway Education Board. Other speakers included Dean A. N. Johnson, College of Engineering, University of Maryland; General Mason M. Patrick, Chief, Air Service, United States Army, and Colonel George A. L. Dumont, French Military Attaché.

"It is hard to realize," said Mr. Graham, "that anything so vital to human kind as transportation should have been so slow in its development. The Man of Nazareth, founder of the faith, and George Washington, founder of his country, living 1800 years apart, knew only the same mediums of transportation. On land they could be hauled by man or beast. On water they were dependent upon the straining muscles of the oarsman or the vagaries of the wind. Yet during all that long period transportation stood still.

"In other directions marvelous advances were made. Inventors achieved both for good and ill. They discovered gunpowder. They invented printing. The great art works of all time, painting, statues, buildings, mountain peaks, of human genius, all came to the world while transportation remained primitive. Actually, the history of modern transportation can be written within the last 120 years. While much has been accomplished, much remains to be done. Education is urgently needed to give highway transport an efficiency that previously it has lacked. Up to date we have to a large extent blundered along.

"I doubt not that there have been made automobiles that did not fit the highways, and highways that did not fit the automobiles. There have been iniquities of taxation. There have been faulty choices of routes. There have been many economic mistakes, based mainly on the fact that the science is so young and the elements so huge.

"I believe that education is ready for this immense task, because its great modern keynote is practicality. This was not always so. The student cannot afford to waste his time, and the colleges, therefore, may live up to their high ideals of service to the public, demonstrated in turning out yearly useful and efficient specialists. But perhaps the greatest boon of transportation concerns itself rather with the lowering of the costs of the necessities and enjoyments of life so that happiness may be widespread. This has an importance that carries it into the realm of economics and statesmanship. It is the reply to the malcontent or Bolshevist who raises his voice against our institutions.

"The automobile is vital to all sections and all classes of people. It gives the farmer access to the nearby town and thus ends his isolation. It brings the school nearer to the children. It shortens the distance from the doctor's office. It is the connecting link between the farm and market. It moves produce when prices are right and develops not only a broader market but a more stabilized one.

"Equally decisive is the advantage to the city worker of moderate means. His car permits himself and family to escape urban squalor and congestion for the health and beauty of the suburbs. It is available to himself and family for a hundred valuable services. The interest

"THE whole program of transportation —in all its phases it must be regarded as that of a single problem, presenting a great many aspects—is among the most pressing and difficult that the entire world is facing at present.

"As you and your associates are probably much better aware than most other people, the transport facilities of the whole world, whether by rail or by water, or whether represented by the great network of public highways, have been confronted with a most difficult situation for a number of years. It is one which demands the very best and wisest treatment from the standpoint of both the technical and economic and financial authorities.

"We are all agreed that the country needs good roads and more of them, but we also have been brought to realize that they are not to be had without very great expense. Your organization is one of those particularly well equipped to deal with the industrial and technical side, as well as the financial aspects of this problem and I most earnestly hope that your Washington convention will produce some useful illumination of the problem."—WARREN G. HARDING.

of the millions, the truest basis of economic law, demands better highway transportation.

"The benefit will spread itself principally to two great classes as follows: First: To three and one-half million farmers dependent upon their automobiles. Second: To as many more city dwelling families with incomes of less than $4,000 per year, who with the farmers, own two-thirds of all the automobiles sold.

"The motor vehicle actually gives this country some 11,000,000 transportation monopolies, all, whether truck or passenger car, subject to schedules and routes made by the owner. This means individual transportation.

"I should like now to be more concrete and to make recommendations concerning the subjects to which educators should give thought in arranging their courses.

"The subject is so big that it involves almost a whole new system of education. I genuinely believe that the various branches of highway transport cover a wide enough range to furnish the exclusive subjects of training for a very considerable college.

Types of Men to Produce

"Without attempting to sub-divide the work or to deal with its minor phases, there seems to me six main types of men you must produce. There are highly remunerative opportunities for all.

"The following is the list:

"1. Road builders,
"2. Motor car producers,
"3. Highway financiers,
"4. Highway lawmakers,
"5. Transportation analysts.
"6. Real estate experts.

"Perhaps the biggest task of all falls to the road builders. In this class I naturally include the highway commissioner, the highway engineer, purveyors of materials and the contractors who actually do the work. To this group is allotted the major responsibility of building roads of sufficient carrying capacity to take whatever traffic be demanded by the nation's economic needs.

"These roads must not only join present populous points but must open new territory. Along with the roads there must be provided adequate maintenance at not excessive cost.

"It has been pointed out by the field marshal of good roads, Chief MacDonald, that our greatest problem is to see that our highways keep pace with increasing highways rolling stock. There has been three times as much investment in rolling stock between 1910 and 1921 as has been expended in the same period for highways construction. It is an enormous responsibility to plan an adequate highway system for a country covering three million square miles.

Highway Program Huge

"Six hundred million dollars were expended last year by Federal, State, county and township divisions upon highway construction and maintenance. In the program is involved the biggest expenditure ever assumed by this country except for war projects. Its total dwarfs the cost of the Panama Canal.

"There are questions of proper routes, studies of subgrade and proper surfacing. The men who will assume this responsibility cannot be too efficient, cannot be too highly trained."

Speaking of the work of the automobile manufacturers, whom he especially represented, Mr. Graham said:

"We want to build automobiles and motor trucks that will adequately serve the public in transportation of persons and commodity, but inflict upon the highways a minimum of damage.

"We constantly aim to lower the price of our units so we may have more users. We seek to get lighter weight without sacrifice of stability, riding comfort or safety. Perhaps the engineer to solve these problems is now a student in one of your colleges. He will be well rewarded for the industry deals in big elements and can afford to pay.

"We have one and a half billions of dollars to invest in our plants. We produce more than two million units of transportation yearly. The wholesale value of cars, trucks, tires and accessories in twelve months amounts to three and one-half billions of dollars. We expend for material one and a quarter billions yearly.

With regard to safety education Mr. Graham said:

"Our industry cannot register too strongly its opposition to overspeeding and overloading. It will welcome any program that will safeguard pedestrians, particularly children. At the same time, the motor vehicle as a medium of great public service must be reasonably protected in its rights.

"There is, also the great issue of the regulation of motor vehicles as common carriers so that they and other mediums of transportation may not suffer unfair competition. Assuming that this become inevitable, it should be friendly to highway transport and not punitive. It should protect the rights of road users and prevent abuses. The expert on highway enactments will find plenty of call for his services. There must also be trained transportation experts who can tell where traffic should properly be allocated. This is the fifth kind of a specialist you can develop. These men can find clients in all lines of activity.

"They will make investigations and advise great manufacturers and merchants where and when they should use railroads, steamships and motor trucks. They can also be of help to the farmer in advising him as to the best means of reaching his market, having in mind all questions of perishable product, seasonable demand and cost of delivery.

Experts Render Real Service

"Transportation adds so much to living costs that it is not difficult to estimate the service that trained experts could render.

"Somewhat related will be the traffic expert who will assist in city planning.

"In forwarding highways development, the educator gives new force to an ancient alliance. Sentimentally and historically the highway has great claims upon him.

"When the settler had blazed his trail through the forest, he built the rude schoolhouse. Ignorance has had no more relentless fee than this combination. The humblest road leads finally to the schoolhouse. The two have been the Damon and Pythias of learning. Except for them there might have been no Lincoln. Now the schoolhouse is outstripping its colleague. Much road mileage remains primitive, but the homes of education have undergone a transformation. The little wooden shack has become the great stone palace of study. Worthy structures have multiplied in all sections of the land. The smallest county boasts its fine high school. If there be but one worthy edifice in a community it is usually dedicated to education.

"Gentlemen, for the good of us all the highway must not be permitted to lag. It must keep pace with the school, so that the union of the two, both freed of politics and both intelligently administered, may render its priceless service to the nation.

"There could be no higher aspiration, no more dignified career, no better citizenship, no more practical patriotism than to strive for this result."

Sociological Aspects of Highways Interest Women

From left to right: Mrs. John Dickinson Sherman, vice-president of the General Federation of Women's Clubs; Miss Florence C. Fox, United States Bureau of Education; Mrs. Edith McClure Patterson, chairman of committee on women and finance, Department of Applied Education, General Federation of Women's Clubs

Leaders of National Federation of Clubs See What Good Roads Mean to Women

A GOOD many people in the automotive industry who appear indifferent to the importance of the development of a greater system of improved highways might well take a lesson from the thoughtful leaders of the General Federation of Women's Clubs. They have begun to realize that good roads have a very real relationship to household economics.

Two of the leaders in this specialized field of education are Mrs. John Dickinson Sherman, vice-president of the General Federation, as well as a member of the sociological committee of the Highway Education Board, and Mrs. Edith McClure Patterson, chairman of the committee on woman and finance of the Department of Applied Education of the Federation.

Both of them look upon good roads as an important element in reducing the cost of living. They will permit the farmer to sell his products to a wider and better market and they will reduce his marketing costs.

For these reasons these broad-visioned women have undertaken a campaign of education which will enlist the housewives in the campaign for a larger system of good roads. They, too, are voters and they will be able to exert a profound influence in state referendums.

Mrs. Patterson, who is a niece of the late John H. Patterson of National Cash Register fame, takes the position that the women of the country expend about five-sevenths of all the money contained in the pay envelopes received by the men of the country and that up to this time they have displayed a sad inability to spend this stupendous sum to the best advantage. She believes that vast amounts can be saved annually if the housewives learn how to market to the best advantage. One of the best ways to bring this about, in her opinion, is the expansion of the highway system which will bring the farmer closer to his markets.

Highways Will Brighten Life on Farms and Relieve Congestion in the Cities

HIGHWAY transportation from a sociological point of view was discussed by C. J. Galpin of the division of farm population and rural life of the Department of Agriculture. A good many of the delegates, as well as most other people, hadn't thought much about road building as a subject for sociological investigation and discussion, but they immediately grasped its possibilities. From the viewpoint of human interest it was one of the most valuable papers presented to the conference.

A committee headed by Dr. Galpin presented a preliminary report which will be followed by another after more mature deliberation. The work which is being done along this line is expected to do much to break down the resistance of farmers to the expenditure of large sums for highways. Once they realize the real social benefits accruing to them from the expansion of the improved roads system they will be less inclined to feel that the city fellow is "putting something over" on them.

Serious Consideration Necessary

"There are two situations in America worthy the attention and serious consideration of all persons who are charged with the responsibility of planning our highways," Galpin said. "I will forego, for lack of time a discussion of the more general social and humanistic phases of our subject and base my claim that sociology is a party to highway construction, on these two situations as types.

"The first situation—and the better known of the two, is the congestion of people being born, living and dying in the residence quarters of most American cities. The second situation—no less acute and no less freighted with far-reaching results, although as yet only dimly recognized by the public in general—is the inaccessibility, taken by and large, of the American farm population, to modern facilities for trade, professional service, hospitals, schools,

From left to right: John H. Mackall, chairman State Road Commission of Maryland; Pyke Johnson, secretary of highways committee, National Automobile Chamber of Commerce; A. W. Campbell, Canadian Commissioner of Highways; Clifford Older, chief highway engineer of Illinois

amusements, and churches. Let us look a little more closely into these two situations.

"IN 1920 America had sixty-eight cities, each with a residing population of from 100,000 to over five millions, with a total population of 27,429,326. One hundred years ago one city in America reached a population of 100,000 persons. Fifty years ago only fourteen cities came up to 100,000 persons each. America has at present 219 cities with a resident population of from 25,000 to 100,000 each, with a total population of 10,340,788; 459 cities, from 10,000 to 25,000; 721 cities, from 5000 to 10,000. The congestion of resident city population concerns especially the 287 cities with a range of population from 25,000 up to five millions.

"It has been evident to sociologists and humanitarians for many years that national well-being suffers from urban residential congestion, by reason of the restricted floor space of urban land in residence areas. Child life and home life are the immediate victims of this congestion. It is difficult to draw a picture which exaggerates the physical, psychic, and social penalties exacted upon a congested population.

"One antidote for this urban congestion is the well-known suburban movement. The benefits of country homes are possessed now by a few fortunate people who do their work in city blocks, but go home to live in space and quiet in the country. The highway engineer is needed sorely at this moment—the engineer with daring imagination, to help scatter the dwelling-houses and residence facilities of every one of these 287 cities far and wide into the outlying open country and thus in some appreciable degree to de-house, de-home and de-residence our congested American cities.

"Automotive traffic in city streets is driving into our consciousness day by day, the crime of rearing and housing our race in business areas, manufacturing districts, and the crowded streets of motor transport in our American cities. A large factor in decentralizing city homes is the transportation problem; and greater hope now arises in the humanitarian heart than ever before as one sees the new transport uses of the American highway. I would like to challenge the genius of highway engineers to help change this urban situation in the interest of the American home.

"IN 1920, America had living on farms a population of 31,614,269 persons, young and old. This is almost 30 per cent of the total population of the United States—slightly less than one-third, and a little less than the total number of persons living in cities of from 25,000 up to five millions. Rural sociologists pretty generally agree that our farm population is tremendously handicapped in the struggle for social equality with people of other occupations in respect to its living conditions—not to mention its economic difficulties—by reason of its present comparative inaccessibility to the modern social facilities and advantages of life. I invite your attention to this situation for a moment, because it is not as simple as one might suppose.

"The fact is that the problem of this inaccessibility of farm homes to the commodities and skilled services and institutions of our modern age, is not simply a matter of waiting until farmers or some other body of people can afford to improve all the rural highways. It is far more complex than that problem, difficult as that may be.

"Rural sociologists are pointing out that the farm population of thirty-odd millions is not being brought into immediate contact with the best commodities of the world and the best thought of the world, through the agency of country stores, small groups of inefficient hamlets and villages, and totally inadequate local institutions—in the main through no fault of the farmer himself. Whereas the thirty-odd millions of people living in cities of 25,000 population and over, are being brought into immediate contact with the commodities, skills, and thought of the world, through the agency of all the devices and facilities which the ingenuity of the age has created.

"THE matter turns into a huge transport problem. How to get the commodities of living; how to bring the skills of service; how to mobilize the institutional wisdom of the world—from the world at large, and bring it to such evenly distributed rail and water terminals, that through an adequate highway system, a certain group of the farm population may find collected most of the things they desire at one of these terminals. In brief, this farm population situation calls for a system of adequate, complete terminal towns, connected by rail and water to wholesaling cities. These terminal towns—ranging in population from 1500 to 5000 souls, each connected by an adequate highway system to a group of farm population ranging from 2000 to 7000 souls respectively, would take the curse off from farming, and, in the words of Theodore Roosevelt, 'Open the door to a good kind of life on the farm.'

"Highway engineers should know this social situation of the farmer, not only in order to help solve it, but also in order not to unwittingly block the coming of a new day for the farm by fastening a highway system upon the farm, which will chain the farmer to frontier facilities for another generation.

"America already has 1320 terminal towns of from 2500 to 5000 population. These, for the most part, stand ready to fall into a system of complete, efficient railway terminals."

Educators Map Out Course For Teaching Highway Regulation and Safety

Committee headed by Dean Hughes of Harvard decides whom to teach, what to teach and how to teach it.

FROM the viewpoint of the industry probably the most important report presented was that of the Committee on teaching highway traffic regulation and safety, headed by Dean C. J. Hughes of the Harvard Engineering School. The report was divided into four parts: Whom to teach; What to teach; How to teach it, and Recommendations. The report follows:

I. Whom to Teach.

A. Those who will design, construct and maintain highways.
B. Those who will design, construct, maintain and operate motor vehicles.
C. Those whose business will be to make highway regulations and enforce them.

II. What to Teach.

A. Design of highway and rolling stock from standpoint of traffic regulation and safety.
(1) Determination of proper width, crown, kind of surface, treatment of curves, parking spaces, safety zones, cross walks, car tracks, street intersections and other details of construction from standpoint of traffic efficiency and safety. This is a logical part of the regular instruction in highway engineering.
(2) Design and construction of motor vehicles from standpoint of safety; brakes, gears, headlights, signaling devices on cars, steering apparatus, tires, non-skid devices and various types of guards.
B. Design of signs, signal and illuminating apparatus and devices.
(1) Traffic guides for pedestrians and drivers, lines in or on pavements, signs, stanchions, traffic-mushrooms, dummy-cops, semaphores, crows-nests and such other devices as may be developed for the guidance of traffic.
(2) Lights. Lights for vehicles, lights for traffic guidance and general illumination.
Color, shape and movement of signs and lights, and light intensities. Ways and means by which best types can be determined and standardized.
C. Regulation of traffic for efficiency and safety.
Compilation and comparison of existing regulations and determination of underlying principles with the ultimate object of determining a unified code which will be generally applicable and acceptable.
D. Traffic administration.
(1) Registration and licensing of vehicles and drivers.
(2) Testing and examination for qualification of drivers.
(3) Education of drivers.
(4) Education of general public in traffic regulations and safety.
(5) Finance.

III. How to Teach It.

A. Regular instruction (course work).
When the fundamental principles have been determined and codified they should be made a part of the regular instruction for all engineers who are likely to deal with any kind of highway transportation problems; but before this is done it will be necessary to make a comprehensive study of these problems. Since subjects to be taught include so many fields of knowledge the instruction must involve many departments of the university, such as psychology and economics, as well as engineering. Instructors from these departments should be brought in and their instruction made an integral part of the course work.
B. Research (the investigation of all phases of design and traffic problems, collection and comparison of data and codification of underlying principles).
There are various methods and agencies which may be utilized:
(1) The National Research Council, acting as a correlating agency for various aspects of the same problems to be worked out in properly equipped universities.
(2) Organizations such as The Eno Foundation for Highway Traffic Regulation, which has already done considerable effective work in this field.
(3) Organizations for the study and promotion of traffic safety.
(4) Automobile and other commercial and industrial associations.
(5) Federal, State and local governmental agencies.
C. Practical training.
Properly organized summer training for undergraduates and graduates by the industries and by Federal, State and local agencies concerned with highway transportation. It is beginning to be recognized that the schools cannot teach practice.
D. Educating the practitioner.
Engineering and motor magazines, as well as general publications, should be more systematically and effectively utilized in disseminating principles and changes in practice.

IV. Recommendations for Gathering Materials and Determining Principles.

The Committee believes that a study of the underlying principles of the best practice in relation to traffic regulation and safety is of fundamental importance. The Committee, therefore, recommends that the Highway Education Board ask The Eno Foundation for Highway Traffic Regulations, Inc., to take up these problems as a continuation of the work of the Council of National Defense for the investigation, codification, publication and standardization of general highway traffic regulations; thus insuring continuity and permanency in the study of these important problems.

Highway and Automotive Engineer Must Join in Research, Hatt Says

Research expert declares consideration must be given to effect on vehicles of roads over which they are operated.

AN analytical paper on Research in Highway Education was presented by Prof. W. K. Hatt, Director, Advisory Board on Highway Research of the National Research Council, in which he said, in part:

Highway engineering is a branch of engineering as distinct as that of railway engineering, and in many respects demanding wider powers from the engineer.

The practice of research is necessary for the advance of the art of the highway engineer to overtake the demands of highway transport that have arisen so quickly and increase so rapidly.

Highway education must not be narrowed to apply alone to training of civil engineers for building roads. These civil engineers now in practice are well upon their way to the accomplishment of their special duties. A need is for instruction in the economics of highway transportation. The part of the national income now spent in highway transportation is disproportionately applied to the vehicle and to the road.

College students should be prepared by a scientific training and consideration for the economics of transport to adjust these items of expense arising from the vehicle and from the road. A discussion of the earning power of capital expenditures in road construction in terms of reduction of transportation costs must enter into highway transportation courses, and a body of sound doctrine promulgated through the colleges.

TEACHERS of highway engineering have sooner or later to discuss the selection of various types of roads to fit specific situations; and also to discuss the factors governing policies in surfacing second-class roads. This discussion must certainly concern itself with the cost of maintenance of the surface. But where are reliable maintenance data? In many cases maintenance charges only indicate that the money came from the maintenance fund, but do not determine its specific use. The relative traffic on the several roads and the distribution of this traffic throughout the year may not have been measured. The quality of materials and climatic conditions, cost of labor, etc., also enter into the comparison; and finally, there is no good measure of the completeness of the maintenance.

What is needed is some uniform accounting system for maintenance costs simple enough to be operated by the ordinary maintenance foreman. Analysis of the data will then permit judgment upon problems confronting highway officials.

The teacher cannot go very far in his discussion without considering the operating cost of the vehicle on the various classes of roads. And when he comes to consider the economics of location, he will have to present data of fuel consumption on grades, and other operating expenses which depend on the characteristics of the vehicle, the use of gears, the limit of maximum speed, etc. How far have our friends, the automotive engineers, progressed in this field?

Of course these data are being gathered more or less slowly in some fields of highway research and fairly rapidly in others. It appears to me that the organization represented here to-day will serve the colleges well by providing some agency to assemble the data from completed and current research, uncover the underlying principles, and prepare a series of brochures for the use of teachers in colleges, supplemented by a supply of lecturers who would present a large view of the problems of the industry of highway transport. Teaching without a basis of scientific information upon which to teach is not an effective process. Such an agency for this service would be provided with a sufficient corps of competent analysts and be financed on a five-year basis.

A CONSIDERATION of the industry of highway transport, with its engineering and economic problems, fits in very nicely with the courses in engineering administration now operative in so many colleges.

Many problems in highway engineering are accompanied by corrolary problems in economics of highway transportation. For instance: How much can an engineer afford to spend in capital costs of construction in reducing grades? The answer must depend on volume of traffic and on operating costs of road and vehicle. Decisions upon changing second class into paved roads involve cost of road maintenance, tire, gasoline, and repairs and depreciation to vehicle. Reliable data appear to be largely wanting.

The cost of highway transportation reflected in the vehicle greatly exceeds that arising from the road. Great are the possibilities of economies in this industry through research into costs of transportation in the fields of vehicle design and operation. The work of the Bureau of Standards in carburation and on tires is notable.

The reflex action of improved grades, alignment and surfaces on change of design and upon operating costs of vehicle also suggests itself. *It is increasingly evident that the highway engineer and the automotive engineer must join forces in highway research.*

THE study of methods of financing road construction of various classes and distribution of expense between those benefited await traffic surveys similar to those now under way in Connecticut. The study itself needs the services of trained economists.

The large volume of valuable data, accumulated at the cost of hundreds of thousands of dollars, at the Bureau of Public Roads, Bates and Pittsburgh test roads, and other test roads, in studies of soil properties, strength of slab and effect of loads, that underlie the mechanics of slab design, should be brought together and analyzed to uncover the principles of action. Then either an engineer can be given the formulas for fitting the road to the load, or final co-ordinated researches can be planned to settle these questions.

The economical life of pavements in given situations must be learned from carefully gathered statistics, so that highway engineer officials may not have to depend upon the views of those urging the adoption of a particular type.

The findings of laboratory tests upon materials of construction should be scrutinized in the light of experience in

operation to determine to what extent they are predictive of the service value of the road.

It must be realized that universities are now active, because the Census of Highway Research recently completed by the Advisory Board shows that out of the total number of 475 reported projects, some 189 of these or nearly 40 per cent are under way in the universities. The research is carried on in the following fields: Economics, 15; operation, 4; design (road), 48; design (vehicle), 5; construction, 3; materials, 114; total, 189.

Horner Tells of Trucking Methods Used in England and Motor Bus Efficiency

F. C. HORNER, in presenting his paper on Mechanical Road Transport Practice in England, France and Germany, gave an outline of his observations in studying this subject in these countries for over a year. Little information regarding France was given. He said that the six-wheel bus used in Paris is still considered in the experimental stage. He dealt only briefly with transport in France and Germany, saying in respect to the latter country that the high cost of fuel makes the use of commercial vehicles there too expensive to be economical except in certain special cases.

In England the things which stand out most prominently are the high load efficiency obtained per unit, the scientific use of four-wheel trailers, demountable bodies and the use of mechanical handling and loading devices at loading stations and on the vehicle itself. From an operating standpoint, the care given in routing and scheduling is important, while the garaging maintenance and repair methods and the careful training of drivers are worthy of special note.

Among the old and large trucking firms is one concern which does a large business in handling cold storage meat from the docks to the London market, and in the haulage of heavy freight from stores, railway terminals, etc. They are extensively using demountable bodies and four-wheel trailers. In large sorting depots they have equipment for handling the demountable bodies and are always striving to improve the service by the use of more efficient methods of operation at both loading and unloading points as well as in the actual operation of the vehicles.

Some of the railways use fleets of trucks equipped with demountable "flats" which are exchangeable between horse drawn vehicles and the motor trucks. This company covers an area of 120 sq. mi., but the average distance each ton is carried is only four miles. It has, however, increased the average weight carried per day from 8 tons 5 cwt.. to 10 tons 18 cwt. since the first "flats" were introduced. This is understood to be a great improvement over ordinary methods under similar traffic conditions.

ONE firm which does a large business in transporting its own products, as well as raw materials, uses all types of road transport from Ford vans to 6-ton steam wagons drawing four-wheel trailers. In transshipping from road to rail they use a type of unit container constructed from duralumin. This container only weighs 40 per cent as much as an oak container and has a capacity of 3 tons of tea in packages. Its use saves much in freight as well as in maintenance. Experiments are being made with a 1-ton fixed body of this material.

Speaking of the motorbus, the advantages of a vehicle designed especially for this service were emphasized, as was also the need for having the service safe, efficient and economical. The charabanc is often operated by small owners while the bus is controlled mostly by companies of considerable size. The charabanc is some times used for tours requiring as much as two weeks, but most trips are for a day or less.

Horner quoted from an address of the British Director General of Roads in which it was pointed out that it is no longer economical to follow the undulations of the terrain in road building. "Directness of line, smoothness of gradient and uniformity of construction are prime considerations; the easiest curve and the amplest sight line must be studiously sought."

Horner said that the English truck operator has learned that overloading is a costly way to make money and is likely to incur heavy fines. Railways who operate trucks have strict rules against overloading and a driver who violates these rules loses his bonus for the day's work.

American Population Problems Hinge on Highway Planning and Building

THE committee on sociological aspects of highway transportation said in its preliminary report:

"As educators plan to provide engineers for modern highway construction, the woman in the farm home will become an active leader in the movement within the range of her influence to the extent in which she is informed that only through the construction of modern highways will the comforts and conveniences now enjoyed by the average city woman be taken to the farm.

"The rearrangement of village life because of highway transportation is something measurable. We are beginning to hear about neglected villages with inferior people living in them, little stagnant pools of humanity where people live a cheap, forgotten existence. The more aggressive families and individuals have moved away. The country around them is sometimes filled with competent and ambitious people on farms who have no patience with the kind of people who make up the little neglected village. All the stronger parts of the population go off to the bigger growing villages. Now the cause of this fact is better roads, and automobiles to run on them. For social work and an understanding of rural social life this magnifying of some villages and depreciating of others is to be borne in mind.

"Good roads are essential in bringing about a closer relation between rural and urban communities and especially is this true as it concerns the women. The city home maker benefits by cheaper cost of food products and the rural woman benefits by being able to dispose of these products and an opportunity to come into contact with the women of the cities.

"In view of the evident fact that the location of improved highways and especially the establishment of permanent systems of highways, are determining factors in the distribution of the American population into residential and social groups, either to the advantage or detriment of national well-being, the committee earnestly makes the following recommendations:

"The U. S. Commissioner of Education is requested to bring to the attention of the heads of engineering schools in the United States the sociological aspects of highways planning. He is further requested to suggest that a short series of lectures be provided each year by the school, college, or university, for engineering students interested in highways; the purpose of these lectures being to present and discuss the American population problems which hinge upon highway planning, construction, and transport."

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE
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Why Not Take Noise Out of Truck

THERE seems to be a general disposition among truck manufacturers to regard with indifference the noisy operation of the vehicles they manufacture. A similar indifference characterized at one time the attitude of passenger car builders. It required a long campaign against the muffler cutout practically to eliminate this nuisance. Manufacturers came to realize that noisy vehicles created prejudice and resulted in sales resistance.

A similar handicap now afflicts the truck and motorcycle industries, although it is less apparent because there are fewer of them. Cutouts are not often supplied by truck makers and mufflers are frequently of such construction that they soon lose their effectiveness, while other parts are so noisy that the vehicle can often be heard a quarter mile or more away. In addition, the warning signals used in some cases make an unearthly racket which is quite useless and leaves those in hearing distance in no happy frame of mind.

All of this creates prejudice which, in one way or another, has a detrimental effect on the use and consequently the sale of trucks. It helps crystallize sentiment which is expressed in adverse legislation or ordinances which prohibit the use of trucks on some highways and otherwise handicap users. Anything which is a public nuisance—and the noise which a truck makes is just that—is certain to react.

There seems to be no good reason why trucks should not be as quiet or nearly as quiet as passenger cars. Just a little more care and attention to detail will bring this about. It's well worth while to make serious efforts in this direction.

The Last of the Hydrogen Ships?

THE recent destruction at San Antonio, Texas, of the Army dirigible C-2, will probably hasten the abandonment of hydrogen and its replacement by helium in all Army and Navy airships. The fire hazard is so great in the case of hydrogen filled ships of the type now used that future military ships will be designed to employ helium as the lifting medium. This is doubtless a wise policy so far as Government-owned ships are concerned, but the high cost of helium and its lower lifting capacity are serious detriments, even though it were available in large quantities, so far as commercial dirigibles are concerned.

The other alternative, as has been pointed out before in these columns, is the development of engines for using less volatile fuels and of non-inflammable fabric or other materials which will retain the hydrogen and prevent its ignition even though a flame comes in contact with the surface of the container. There is doubtless much experimental work to be done before this alternative becomes a reality, but research work in this direction is in progress, at least so far as the engine is concerned. All-metal airplanes have been constructed, but whether all-metal construction can be successfully applied in the construction of dirigibles remains to be seen.

If this comes about competent engineers believe that hydrogen can be employed with comparative safety. On the other hand a combustible gas such as hydrogen will always increase the fire hazard as compared to a non-combustible such as helium, no matter what engine fuel or gas container is employed.

It is hard to conceive of a container which might not be ripped open, for example, in an accident similar to that which occurred in the case of the C-2 when strong gusts of wind caught it as it was being taken from the hangar. From a comparatively small rupture hydrogen might issue and burn as a jet, but a large tear might easily release large volumes of gas. Hydrogen and air form a highly combustible mixture the ignition of which might easily result in an explosion of sufficient violence to wreck a ship.

No doubt the problem of safe commercial flight in lighter than air craft will ultimately be solved, but there is still much to be done before such an ideal is realized.

An Old Skeleton Dressed Up in New Clothes

By James Dalton

McCREADY SYKES, who says that in the past he has been "intimately engaged" in the development of the good roads movement, with "an active part in drafting legislation in furtherance of its aims," is the author of an article in a recent issue of *Commerce and Finance*, in which he inquires, "Has the Good Roads Movement Gone Far Enough?"

Mr. Sykes is greatly concerned because the States of the country have bonded themselves for $1,071,506,981, of which $367,687,100, or 34.3 per cent, has gone for the construction of highways. He finds no particular fault with an expenditure of $213,891,400, or 20 per cent, for waterways and harbors, but he does ask this significant question about bond issues for highways:

"Is it not possible that the railways could use a portion of this outlay, if it were loaned to them, with greater benefit to the public?"

This naive inquiry causes us to wonder whether the proposal is about to be made, in behalf of the railroads, that the States shall come to their relief and perhaps finance the construction of much needed additions which would take them into districts now served by motor vehicles. The neglect of the needs of the railroads has been very sad, indeed, especially so in the early days when they were given nothing except huge chunks of the public domain. This real estate later became quite valuable.

Mr. Sykes makes the rather surprising statement that "under modern conditions of traffic a highway's disintegration begins almost the week after the traffic barricades have been lifted." It is the more surprising coming from one who has been "intimately engaged" in the development of good roads.

We believe that if Mr. Sykes will carry his investigation a little further he will learn that improved highways never wear out if they are properly maintained. That fact has been proven beyond dispute in Maryland and Massachusetts, to mention only the two States which come to mind first. There is at least one perfectly good road in Maryland, now carrying heavy traffic, which antedates the canal period.

With this fundamentally erroneous premise, Sykes contends that "almost without exception these bond issues for highway purposes transgress the accepted principle that the life of a public debt should not exceed the probable life of the improvement for which it was incurred."

We fear that since Mr. Sykes transferred his efforts from the development of highways to some other field, he has not kept pace with the practices in vogue in highway maintenance. Perhaps the following paragraph from his article expresses his views on the subject of maintenance:

"A road whose surface has thus been ruined (by automobiles operated at a speed exceeding 20 m.p.h.) remains, nevertheless, a practicable highway, able to carry vehicular traffic in summer and winter and affording dry passage for pedestrians. As a speedway for automobiles it is neither inviting nor comfortable, but between such a road and the old country road, impassable in the spring and filled with gullies and bumpy rocks the rest of the year, there is simply no comparison."

Later on, he inquires: "Would it not be better to maintain what we have than to pile up staggering debts for our children who will be paying for roads worn out long before the debt for building them is discharged?"

Acceptance of any such ideas as those advanced by Mr. Sykes would pre-suppose a desire on the part of the American people to stop the wheels of progress and stand still for an indeterminate period.

That is what the railroads have done. They long ago ceased to extend their systems and they have failed utterly to keep pace with the steadily increasing population. They once were able to handle the maximum of freight traffic offered them by the country, but that was a long time ago. Their equipment now is wholly inadequate to cope with the needs of traffic. It is true that they have ordered rolling stock in considerable quantities but when it is delivered it will be little more than a drop in the bucket.

It was inability of the railroads to handle the freight traffic offered them which resulted in the development of highway transport. It is their continued inability to handle it which will result in further development.

Do the railroads expect business in the United States to stand still while they catch up?

It is such specious arguments as those presented by Sykes which the automotive industry must combat by the presentation of the plain truth.

It's the same old story, the same familiar propaganda, couched in a little different language but built around the same framework. The message it seeks to carry is that the States should cease to build highways for the benefit of motor vehicles. The inference is that the people of the United States should let their roads wear out so the railroads can carry not only the freight but the passengers which are now transported by trucks and passenger cars.

Output in October Reached 244,000

Total for 10 Months Placed at 2,119,000

Almost Equals Production for Full Twelve Months of Banner Year, 1920

NEW YORK, Nov. 1—October has produced another surprise for the industry.

That month not only broke all previous production records for the tenth month of the year but it proved to be the seventh consecutive month in which the 200,000 mark was exceeded. Counting October, nearly as many motor vehicles have been produced in the 10 months of this year than in the full 12 months of the banner year, which was 1920.

The report of the National Automobile Chamber of Commerce to its directors to-day states that the approximate production for October was 244,000, or nearly 40,000 over September and bettering the previous best October—1920—when production was about 200,000. This report is based on shipping reports for the first three weeks of the month from N. A. C. C. members and for Ford for the full month.

Total production for the 10 months is estimated at 2,119,000.

Ford Back in Production

The big increase over September is explained by Ford getting back into production. The four-day layoff of the Ford plants in September prevented that month from holding its place in line. Ford is not back to capacity production as yet, according to reports from Detroit, which place his daily average at the present time at about 4800, whereas his capacity is 5200. With Ford going at his limit, it is more than likely October would have run close to June, the peak month of the year with 289,011.

This enormous delivery of cars in October was not accomplished without great effort on the part of the various traffic managers, for it is very evident that the transportation situation is becoming more serious. It is still extremely difficult to get freight cars.

Driveaways are increasing, which is to be expected in view of the railroad situation, although Ford seems to be meeting with a good break in luck, for his car shipments have been improving while his driveaways have decreased within the past months.

Business in Brief

NEW YORK, Nov. 1—General trade and industrial activity lacks uniformity due to weather irregularities. Wholesale and jobbing trade shows an advance and commodities as a whole tend upward in spite of some declines. Employment is good with indications that lines now complaining of scarcity will before long find an increased supply of unskilled labor available.

A slight easing of car shortage is noted in some sections, but the Pacific Coast, southern coal and lumber districts, northwest spring-wheat sections and lower lake regions are complaining of acute conditions.

Car loadings are slightly below those of the last week in September, although showing a gain over last week. They are only 3.4 per cent below the peak totals touched during the second week of October, 1920. Total loadings were 983,470 for the week, a gain of 15,301 over the previous week.

Textiles easily lead in strength of prices and widespread buying. It indicates the stimulating effects of recent tariff legislation. Steel is easier while scrap metal, pig iron and coke are lower. This is regarded as indicating the removal of the artificial barrier of scarcity caused by the rail and coal strikes. Railways continue to be the best buyers and it is reported that leading interests have been forced to go into the open market for steel to fill orders.

Soft coal output continues to gain with indications that the peak production has yet to be reached. 10,200,000 tons were produced in the week ending Oct. 21. Anthracite output approximated 2,000,000 tons.

Industrial stocks were carried to new low levels by profit-taking and bear drives. Rails suffered with the rest but gaining stability. Call money rose to 6 per cent. Liberty issues were particularly weak and the new Treasury 4½'s sold for the first time below par.

Closed Car Demand Keeps Up Schedules

Difficulty Still Experienced in Getting Material and Making Deliveries

NEW YORK, Oct. 30—Production continues to be maintained at a high rate in the face of obstacles occasioned by the railroad situation. It is increasingly difficult to get through shipments of materials, despite various means adopted to expedite deliveries. The diversion to other uses of such rail equipment as would be available for automotive manufacturing centers has necessitated a wider use of motor trucks, augmented by the employment of boats for shipments from more distant points.

The popularity of the closed car is a dominant factor in the maintenance of high production programs. Some factories are reporting a shortage of bodies for cars of this type, due to the unexpected demand at a season when in other years there has come a perceptible falling off. Where there has been a curtailment of manufacturing schedules it has been due to the inability to obtain a sufficient body supply rather than to any pronounced decline in sales.

Driveaways Increasing

With the freight car shortage situation becoming more serious, the industry is experiencing as great difficulty in shipping its products as in getting its material. Although driveaways are increasing in number they are unable to take care of all the orders in dealers' hands. Manufacturers located at such points as Detroit and Cleveland are making use of boat shipments, to a great extent, to get their products into dealer territories. The Northwest, in particular, where there is strong evidence of renewed buying interest, is being fed in this manner; but even there deliveries are behind.

The export field is experiencing somewhat the same excellent conditions as regards sales as are apparent in the domestic market. It is very likely that the present year will prove the second best in point of shipments in the history of the industry, exceeded only by 1920. A marked in-

(*Continued on page* 901)

Rubber Restriction Relief Sought

Association Moves by Cabling London

Committee Named — Thought Curtailment Will Mean Higher Prices for Tires

NEW YORK, Oct. 30 — Great Britain's sanction of the plan to compel restriction of output by means of a graduated scale of export duties on all rubber shipped from Ceylon, Malaya and the Straits Settlements has resulted in the appointment of a special committee representing the Rubber Association of America "to proceed with an investigation of the effect of the proposed crude rubber restriction."

This committee will take steps at once to bring about close contact with the Rubber Growers' Association of London for the purpose of giving joint consideration to the development of a plan for safeguarding the interests of the crude rubber grower and the consumer.

Directors of the Rubber Association of America held a special meeting for the purpose of naming this committee, which consists of: Chairman, H. Stuart Hotchkiss, president of the United States Rubber Plantation Co. and attorney for the United States Rubber Co.; B. G. Work, president of the B. F. Goodrich Co.; Horace De Lisser, chairman of the board of directors of the Ajax Rubber Co.; A. H. Brown of Meyer & Brown, crude rubber importers, and S. G. Carkhuff, secretary of the Firestone Tire & Rubber Co.

Co-operation Offered

This committee at once cabled the Rubber Growers' Association asking that a committee be sent here to discuss plans which will protect the mutual interests of consumers and producers. Hotchkiss, in the cable, declared that "it is thought the proposed restriction carries with it great danger to the entire industry, planters and manufacturers alike, and that closer contact between the growers and consumers will be beneficial to the industry as a whole." Up to to-day no response to the cable has been received.

The special meeting of the Rubber Association's directors was brought about by the sharp advances in the price of crude rubber which followed the announcement that the British government had sanctioned the proposed taxation plan. Members were anxious to have determined for them the effect of restriction on the stability of the industry. Several suggestions were received by the directors such as enlisting the aid of the Department of State and the Department of Commerce of the American Government and also cabling a protest against the passage of this restriction act to the colonial governments of the Far East. The appointment of the Hotchkiss committee was the compromise reached.

The restriction is expected to go into effect to-morrow, the idea being to limit production until prices become more satisfactory. The plan adopts as the stand-

(*Continued on page* 905)

Railroad Situation Is Big Factor in Retarding Progress of Business Throughout Country

By Hugh Chalmers

Director, Maxwell Motor Corp. and Chairman of the Board of the Joyce Manufacturing Co.

Detroit, Oct. 30.

THOUGH the business of the country to-day is good and is showing steady improvement, there is no question but that it would be much better if it were not for the recent railroad strike and the resulting congestion and confusion under which the industries of the country are laboring.

What the railroads need, as I view it, is new blood in the executive ranks. Practically all directing officers of the railroads are men who have grown old in the service, advancing from post to post according to their years with the company. Such a system offers a barrier to new ideas and modern methods. Business men should be brought in from the outside frequently to supply an enlivening influence to a business which has been accustomed too much to routine methods.

The railroads could study with a great deal of profit the methods of Henry Ford in the management and organization of his affairs. Railroads need men of genius like Ford to keep their service up to a high efficiency standard. They must pay wages that will keep employees at maximum efficiency.

Furthermore, it is the duty of the Government to provide regulations that will prevent any possibility of suspension of transportation service such as has been witnessed this year. The great body of the American people cannot be made the victim of a recurrence of such a situation. If necessary, the Interstate Commerce Commission should be disbanded and a new commission formed which would have absolute control of all public utilities. It does not make any difference whether such a commission has the confidence of the railroad executives or labor organizations as long as it has the confidence of the public. With a commission backed by the public and armed with proper regulatory authority there would be no disturbance of transportation facilities in the future.

The coming year should be one of the best in the automobile business. Buying has fallen off now, but only in comparison with the rest of the year, and not in comparison with the same season in other years. Manufacturers are handicapped by shortage of closed bodies, and the big demand of the season is for closed work. Those manufacturers who are able to get closed bodies in quantity are maintaining operations on schedules approximating those of the earlier year. Plants which have fallen off largely in production are those without adequate closed body supply. Several manufacturers are months behind on closed body orders.

Manufacturers must prepare to meet the closed car demand of the future. There will be a large increase in closed body demand next year over that of 1922, and percentage of closed production this year has been larger than in any year previous.

Durant to Use Factory in Elizabeth for Bodies

NEW YORK, Oct. 30—Part of Durant's big plant at Elizabeth, N. J., will be utilized for body building. It will be occupied by the new body building concern which is being organized by Jay Hayes and Victor Preston of the Hayes-Ionia Co. of Grand Rapids, Mich.

As yet no name has been selected for the company, but it is understood that it is a separate and distinct organization from the Hayes-Ionia Co. While it will not be a part of the Durant organization at present, it is thought that it will be taken into the fold later.

Apperson to Obtain New Working Funds

First Mortgage Bonds to Be Issued to Provide for Production of Light Car

CHICAGO, Oct. 30—New capital of $700,000 is to be provided for the Apperson Bros. Automobile Co. of Kokomo, Ind., under a plan of re-financing which contemplates the bringing out next spring of a new light car in addition to the regular 8-cylinder model.

The new finance is to come from an issue of first mortgage gold bonds which will be offered through the firm of A. S. Terrill & Co. of Chicago and New York. The bonds will bear 7 per cent interest and will mature $40,000 annually beginning Oct. 1, 1924, the balance Oct. 1, 1932. The trustees will be the First Trust & Savings Bank of Chicago, and George L. Davis, vice-president, Howard National Bank, Kokomo.

Detailed plans for the new light car are not yet ready for announcement. The car probably will be known as the Apperson Junior. It is specifically stated that the standard 8-cylinder Apperson chassis will be continued. The production for next year is estimated at 2500 8-cylinder cars and 4000 of the smaller models.

The balance sheet prepared on the basis of the new financing shows that the company's total current assets are $1,863,156 as compared with current liabilities of $606,073, or about three to one.

Profit of $300,000 Indicated

A statement by Edgar L. Apperson, president of the company, says that the result of operation to Sept. 30, 1922, indicates a profit for the year ending Dec. 31 exceeding $300,000. Average annual earnings for the five years, 1916 to 1920, inclusive, are given as $199,238. The loss for the year 1921, after writing off depreciation of inventory, is given as $9,311. The parts business is said to amount to over $300,000 a year.

The purpose of the bond issue, as stated by Apperson, "is to provide for additional models and add to working capital." The bond issue will be secured by a closed first mortgage covering all plants, real estate and fixed assets of the company.

Following is the condensed balance sheet prepared on the basis of the new finance arrangement:

ASSETS

Current:		
Cash	$186,568	
Accounts receivable	273,922	
Notes receivable	52,624	
Inventories	1,350,041	
Total current assets		$1,863,156
Deferred charges to profit and loss		1,619
Investments		17,500
Fixed:		
Real estate, plant and equipment, depreciated value		1,363,104
Total assets		$3,245,379

GASOLINE COSUMPTION ESTIMATED FOR 1923

WASHINGTON, Oct. 30—Gasoline consumption for the calendar year of 1923 will be 5,670,000,000 gallons, it is estimated by the American Petroleum Institute. The figure is arrived at by an estimate showing that there will be 13,500,000 gasoline engines in use in 1923, each using an average of 420 gallons of gasoline.

At the present rate of refining methods—one barrel of gasoline secured from each four barrels of crude—the total petroleum requirements of crude oil will be 540,000,000 barrels.

LIABILITIES

Bills and accounts payable		$606,073
Reserve for taxes	$15,301	
Bond issue	700,000	
Preferred stock	600,000	
Common stock	1,250,000	
Surplus	74,004	
		2,639,305
Total liabilities		$3,245,379

Revere Closes Its Doors on Eve of Sale of Plant

LOGANSPORT, IND., Oct. 26—Judge Paul M. Souder announced the holding up of the sale of the Revere automobile plant of this city until the middle of next week. It is understood that at the time of the announcement of the postponement of the sale that only one bid had been received. Whether the judge will approve of the sale if no further bids are received was not disclosed in the announcement.

The plant closes its doors to-night, after having been operated continuously under the receivers, the Citizens' Loan & Trust Co. of this city. It is said that until recently, the employees of the plant have been kept busy.

Locomobile Transferred Formally to New Company

NEW YORK Oct. 30—By order of Referee Keogh the property of the Locomobile Co. of America at Bridgeport, Conn., has been formally transferred by the trustees to the new Locomobile Co. of America, a New York corporation, which is controlled by W. C. Durant. The new interests are proceeding along the policy decided upon when Durant first took over Locomobile.

The schedule calls for the manufacture of 800 cars during the 1923 season, and 1000 men will be employed at the Bridgeport plant. No new models will be added nor will there be any price changes. The sales organization will be strengthened in all parts of the country, and new district representatives added in those sections where the conditions demand them.

Fewer Hudson, Essex Models Will Be Made

Four Types Dropped — Action Fits in With New Dealer Financing Plan

DETROIT, Nov. 1—Hudson Motor Car Co. has reduced the number of Hudson and Essex models to seven by taking out of its line the four higher priced closed models, including a touring limousine, limousine, cabriolet and sedan.

This is a material change from past policies, for in one year Hudson and Essex produced as many as 12 different body types. Before the Essex came into being there was one season in which Hudson alone had nine models.

The new policy is to enable the dealer to concentrate on a few fast selling models rather than to attempt to cover the entire field of motoring demands. The closed car proportion of the entire Hudson-Essex production now is 56 per cent and even this will be greatly increased in 1923.

Decision to reduce the number of models is made to aid in the carrying out of the Hudson company's new dealer finance plan, which aims to lessen the problems of the dealers handling the two lines. Realizing the financial problems of the smaller dealer, the company has developed a plan which permits of the handling of cars throughout the year at an unusually small expense.

The details are very much along the lines of the usual national financing plan, but it is claimed that because the expense to the dealer is small and the plan combines the virtues of dependability and an economical interest charge on the money advanced it cannot help but be successful.

Rolls-Royce of America Issues $2,000,000 Bonds

NEW YORK, Nov. 1—Rolls-Royce Co. of America, Inc., is issuing $2,000,000 15-year 7 per cent sinking fund gold bonds of an authorized issue of $3,000,000. The proceeds will be used for refunding higher interest-bearing obligations and the remainder for working capital.

While this issue will be used in no way for plant expansion, it will facilitate a slight increase in production, officials declaring that it is possible to increase output to more than 450 cars a year.

The plant is now running at capacity. Earnings since May 1 have been at the rate of over twice the interest charges and orders on hand, it is said, will enable the company to exceed this mark.

AMERICAN PETROLEUM MEETING

ST. LOUIS, Nov. 1—The third annual meeting of the American Petroleum Institute will be held at the Hotel Statler in this city on Dec. 6, 7 and 8.

468,355 Estimated As G.M. 1922 Sales

Total Value for First Six Months Promises to Make Year Company's Best

NEW YORK, Nov. 1—Estimating the last quarter, total sales of the motor vehicle manufacturing units of the General Motors Corp. in 1922 will aggregate 468,355, which will give the corporation the greatest year in its history. With net sales of $218,859,267 for the first six months of the year, it is very likely that in dollar value 1922 will top 1920, the best previous year, when the net for the twelve months was $567,320,603.

Stockholders are given this information in facts and figures, prepared by the Department of Financial Publicity of G. M. C. There are 70,000 stockholders at the present time, a considerable growth in the last year. At the end of 1921 there were 66,837 of all classes, while in 1920 there were 36,894; 18,214 in 1919; 4379 in 1918 and 2920 in 1917. Of the 70,000 there are 41,144 owning 100 shares or fewer and only 7410 who own more than 100 shares of common.

Preferred Stocks Worth $380

On June 30, 1922, the book value of the preferred and debenture stocks was over $380 per share; and of the common stock $14 a share.

"Few realize that the combined value of the products sold annually by the General Motors group during the past few years is greater than the annual revenue of any railroad; and further, is exceeded by few industrial corporations," the booklet says.

Net sales by years ended Dec. 31, follow:

1922*	$218,859,267
1921	352,527,386
1920	567,320,603
1919	509,676,694
1918	269,796,829
1917**	96,295,740

*Six months ended June 30.
**Five months ended Dec. 31.

The excess of current assets over current liabilities (net working capital) June 30, 1922, was $122,725,264. Cash in banks was $35,527,973. Sight drafts, $10,430,382; notes and accounts receivable, $21,899,134, and inventory, $94,166,601. Current liabilities include accounts payable, $22,184,843; taxes, payrolls, etc., $16,979,253, and accrued dividends, $1,068,354.

2,000,000 Cars Since 1905

Facts and Figures says:

General Motors, since 1905, has produced over 2,000,000 passenger cars. Of this number approximately 75 per cent, or more than 1,500,000, were in use on Jan. 1, 1922. According to the National Automobile Chamber of Commerce, there are 9,300,000 passenger automobiles in the United States. To be conservative, at least one out of every seven passenger cars is a Greater Motors product. Since one out of every seven is a General Motors car it follows that this group carries approximately one billion passengers annually—approximately the number of passengers carried by all the steam railroads in this country.

General Motors Produced 316,136 Cars and Trucks In First Three Quarters of Current Year

NEW YORK, Nov. 1—The combined sales by the car and truck divisions of General Motors in the first quarter of this year totaled 71,039; the second quarter, 135,751; and the third quarter, 109,346. This makes a total for the first nine months of 1922 of 316,136, which exceeds the full 12 months of 1921.

The sales for the year to end Dec. 31, 1922 (last quarter estimated), compared with the actual sales of the three preceding calendar years, follow:

	*1922	1921	1920	1919
Passenger Cars:				
Buick	134,000	83,888	116,213	119,853
Cadillac	22,000	11,130	19,790	19,851
Chevrolet	249,000	75,667	144,502	132,710
Oakland	26,000	12,661	37,244	54,451
Oldsmobile	23,000	20,245	26,241	33,345
Commercial Cars:				
Chevrolet	2,900	1,489	4,938	2,682
GMC Trucks	5,600	2,760	5,137	7,730
Oldsmobile	1,500	466	8,383	7,782
Totals:				
Passenger Cars	454,000	203,591	343,990	360,210
Commercial Cars	10,000	4,715	18,458	18,194
Miscellaneous**	4,355	6,493	30,627	13,334
Grand total	*468,355	214,799	393,075	391,738

***Based upon the actual sales for the first nine months of 1922 together with estimates for the last three months.**
****Includes tractors, and also cars and trucks not now manufactured.**

Kelsey Remains Manager When Receiver Is Named

NEWARK, N. J., Oct. 30—Judge Bodine of the United States District Court at Trenton has appointed Stewart A. Young of this city receiver for the Kelsey Motor Co. upon application of C. W. Kelsey, vice-president and general manager. In petitioning the court, Kelsey acted for his mother, Mrs. J. W. Kelsey of Philadelphia, from whom he borrowed $10,000 to lend the company. Liabilities are placed at $90,000, but the assets are said to be five times this amount.

Temporary shortage of funds, caused by a change in the financing of the company, is assigned by Kelsey as the reason for the receivership. It is asserted that the receiver soon will straighten out matters and will be discharged within 90 days. Manufacturing operations will be continued with Kelsey as general manager.

The Kelsey company, organized about two years ago, is manufacturing a friction drive car. Recently a gear drive model was added to the line.

416 M. A. M. A. MEMBERS

NEW YORK, Oct. 30—The Motor and Accessory Manufacturers' Association has just broken a record, a membership record. It now has enrolled 416 companies, a net gain of 25 in the last 12 months. This is the highest total reached in its 18 years' existence.

Money Easier, Banks in Southwest Report

KANSAS CITY, MO., Nov. 1—The monthly review by the Federal Reserve Bank of Kansas City, covering conditions in the Tenth district, show a very interesting accession of prosperity to this district. The condition of 79 selected member banks reflects the loosening of money, and the largely increased volume of production and distribution.

The Federal Reserve Bank itself and the branches in Omaha, Denver and Oklahoma City, show higher levels of discounted and purchased bills and also notes of circulation, during September, than since June. The gross deposits of the selected member banks are the highest of record; as are the combined loans and discounts and investments.

Another statistical angle reflects improvement negatively—car shortage continues, retarding distribution. Farmers in western Kansas, it is known from other than Federal reserve sources, lack cars for wheat shipment, and the report points to very general distress over lack of cars in many sections of the district.

Other reports aside from the Federal Reserve bulletin, are that with the stiffening prices in many commodities, especially cotton, retailers are buying and placing orders more freely, though conservatively.

VAN KERR IN RECEIVERSHIP

CHICAGO, Oct. 30—A petition in bankruptcy has been filed in Federal Court here against the Van Kerr Co., manufacturer of spark intensifiers for use on spark plugs. Fred E. Hummel has been appointed receiver.

Studebaker to Build 110,000 Cars in 1922

Schedule for Fourth Quarter Calls for 20,000—Regular Dividend Declared

SOUTH BEND, IND., Nov. 1—Directors of the Studebaker Corp. at their meeting to-day declared the regular quarterly dividend of 2½ per cent on the common capital stock and the regular 1¾ per cent on the preferred. The extra dividend on the common was eliminated.

It had been expected that the directors would continue this extra dividend which was granted three months ago, when the regular dividend on common was increased from 1¾ to 2½ per cent, thus placing the stock on a regular 10 per cent annual basis, as compared with the previous rate of 7 per cent.

The Studebaker report for the quarter tells of capacity operations and the sales demand ahead of production. There were 29,924 Studebakers produced and 30,199 sold. Production schedules for the fourth quarter call for 20,000 cars, which will make 110,000 for the year as against 66,000 in 1921.

While the net profits of the third quarter—$4,483,973—are less per car than those of the second quarter, because of price reductions of about 10 per cent in August, they are nevertheless high enough to satisfy the management.

The consolidated balance sheet of the Studebaker Corp. and subsidiary companies is as follows:

ASSETS

	Sept. 30, 1922	Dec. 31, 1921
Cash	$20,123,734	$8,334,799
Sight drafts outstanding	4,137,804	1,822,393
Investments	3,563,590	2,178,170
Net receivable (less reserves)	6,176,207	4,035,221
Inventories	15,101,740	22,209,885
Deferred charges	623,219	394,262
	$49,726,297	$38,974,732

QUICK ASSETS

Plants and property	$38,903,832	$37,290,413
Housing development	1,706,005	2,255,715
Trade name and goodwill	19,807,276	19,807,276
Total	$110,143,411	$98,328,138

LIABILITIES

Accounts payable—current	$4,046,504	$3,492,414
Reserve for taxes	3,642,646	2,904,373
Reserve dealers' discount and deposits	1,292,641	1,306,446
Other payable reserves	2,799,875	2,545,160
	$11,781,667	$10,248,394

ALL LIABILITIES

Preferred stock	$9,450,000	$9,800,000
Common stock	60,000,000	60,000,000
Special surplus	4,455,000	4,050,000
Surplus	24,456,743	14,229,743
Total	$110,143,411	$98,328,138

The statement of comparative profit and loss and surplus as of Sept. 30 is as follows:

THIRD QUARTER

	1922	1921
Number produced	29,924	23,338
Number sold	30,199	21,086
Net sales	$35,065,894	$29,058,893
Net profits before taxes	4,934,370	4,251,867
Less reserves for U. S. and Canadian taxes	450,397	988,667
Net profits	4,483,973	3,263,200
Less dividends	2,565,375	1,221,500
Surplus	1,918,598	2,041,700

FIRST NINE MONTHS

	1922	1921
Number cars produced	87,951	56,163
Number cars sold	90,252	55,552
Net sales	$108,488,756	$80,593,998
Net profits before taxes	17,621,133	11,644,326
Less reserves for U. S. and Canadian taxes	1,980,759	2,000,000
Net profits	15,640,374	9,644,326
Less dividends	5,008,375	3,664,500
Surplus	10,631,999	5,979,826
Prior surplus	18,279,743	13,467,047
Total surplus	28,911,743	19,446,874

Prices Reduced of Dort Four; "Six" Lists Fixed

FLINT, MICH., Nov. 1—Coincident with the announcement of the Dort six comes the information that some minor changes have been made in the four, together with a price reduction. Following are the new and old prices on the Four:

Model	Old Price	New Price
Phaeton	$885	$865
Roadster	885	865
Yale sedan	1,095	1,070
Yale coupe	1,045	1,020
Harvard sedan	1,385	1,370
Harvard coupe	1,265	1,240

Prices of the Dort six are as follows:

5-pass. phaeton	$990
3-pass. roadster	990
5-pass. Yale sedan	1,195
3-pass. Yale coupe	1,145
5-pass. Harvard sedan	1,495
3-pass. Harvard coupe	1,365

Fiat Makes Radical Cut in Prices of Two Models

NEW YORK, Oct. 31—Fiat has announced a radical price reduction on its large 4-cylinder line, model 501, and 6-cylinder cars, model 510. Model 501, the small 4 cylinder line remains unchanged. The new prices are as follows:

Model 505

	Old Price	New Price
Phaeton	$3,500	$2,500
Sedan	5,000	2,900
Landaulet	4,700	2,900

Model 510

	Old Price	New Price
Phaeton	$5,400	$3,700
Landaulet	5,500	4,500
Brougham	5,500	4,500

MASON TO INCREASE

NEW YORK, Nov. 1—The Mason Tire & Rubber Co. will advance tire prices approximately 5 per cent Nov. 15.

Los Angeles Public Confused by Prices

Some Dealers Advertise Cars F. O. B. Factory—Others at Delivery Point

LOS ANGELES, Nov. 1—Despite recent agitation favorable to advertising prices of motor vehicles for delivery at California points, the majority of dealers continue to quote factory prices. Some have switched over to local delivery prices and as a result the buying public is very much confused.

Agitation in favor of advertising local prices is growing and the solution for the whole affair might be brought about if a dozen of the largest distributors in this State would depart from an established custom.

Some dealers maintain they should have the privilege of selling their merchandise as do dealers in other commodities. They maintain the public knows nothing about the cost of most articles at an eastern factory point and cares less, but the buyer is concerned as to what his outlay will be. It is cited that the highest quality and most expensive furniture originates in the East. In their national advertising the furniture factories refrain from price quotations. The California merchant advertises the sales price to the buyer and that in the end proves the only factor worth consideration.

Dealers Are in Quandary

As the result of the agitation of the advertised prices of automobiles, the dealers themselves are in a quandary as to the course to pursue. When a person reads a section of the newspaper devoted to automobile advertising he is interested in the price. That is more because the automobile manufacturers have emphasized price above quality, judging by the display made. A survey of the advertising columns leaves the reader guessing and unless he knows the location of every factory whose product is advertised and can approximate the freight charges, the advertising becomes a Chinese puzzle.

The question of "handling charge" also enters. Knowing the factory price, the customer asks the cost of the freight and can figure the war tax. In many instances there still remains a discrepancy between the total of these three sums and the actual retail price. The dealer says the difference represents the "handling charge."

ELGIN STILL OPERATING

CHICAGO, Nov. 1—The Elgin Motor Car Corp., for which a receiver was appointed in Federal Court two weeks ago, is operating under permission of the court to produce as many cars as the materials and units on hand are sufficient for without the purchase of additional materials. This point will be reached within a few days.

Trucks Finding New Markets, Says Fenn

Industry in Wonderful Shape at Present, He Reports After Tour of Plants

NEW YORK, Oct. 30—The motor truck industry, all things considered, is in wonderful shape at present. It is doing 75 per cent more business now than it was at the beginning of the year; all its plants are busy, some of them at capacity, and new markets have been opened that promise much business in the immediate future. September was a rare production month, showing an increase of 35 per cent over the same month a year ago.

These are the conclusions reached by F. W. Fenn, secretary of the motor truck division of the National Automobile Chamber of Commerce, after two weeks spent in visiting some 15 factories in different parts of the country.

Demand for Rail Cars

In speaking of the situation, Fenn says:

General business is the barometer of the truck industry. When business is good we will sell trucks and lots of them, and I am glad to report that business is coming back. There is a labor shortage in all the industrial centers, the demand for trucks is surprising everyone and new markets are opening for us which tell us that we are just scratching the surface right now.

I find a great demand for rail cars. The railroads are coming into the market and not only want these rail cars but also need trucks for short hauls and for store-door deliveries. The carriers are finding that they must either take to the motor trucks and store-door deliveries or spend millions building new terminals on the outskirts of the big cities. The electric railways, too, are proving good customers through frankly taking up the motor bus as a feeder to their main lines. The boom in highway building also has helped matters.

Of great benefit to the industry is the decisions of the public service commissions of New York and California, which have held that trucks and buses are necessary to the public and have granted franchises for the operation of business despite the protest of the trolleys.

Good Farm Outlook

I also feel that the farmers are going to prove mighty good customers. As soon as they sell their crops and get some ready money, I think we are going to hear from them in a substantial way.

In my swing through the country I found everyone busy and very optimistic. Mack, Federal and White are going strong. At Diamond T I found great activity because of the fact that the American Railway Express is taking most of the output. Four-Wheel Drive at Clintonville is building flanged wheel trucks for use on the railroads of Porto Rico, Japan and China. Foreign business with them is good.

Graham at Detroit and Clintonville has announced a complete line of bodies for smaller haulage work, which has met with great success. The Graham is powered with Dodge engines and distributed by Dodge Brothers dealers. The Walker electric at Chicago reports many orders and great activity in the sales department, while the Watson Wagon Works at Canastota, N. Y., is doing so well that it has discharged the receiver who has been at the helm for some time.

TRACTOR MAKES LONG CROSS-COUNTRY TOUR

WATERTOWN, WIS., Oct. 30—One of the longest cross-country tours ever made by a tractor is that now nearing its end at New Orleans. On Oct. 8 a Monarch tractor, manufactured by the Monarch Tractor Co., left the factory with greetings from city officials and the chamber of commerce. The tractor is preceded by E. L. Woods, sales manager of the company, in a phaeton.

At Madison, the governor and other State officials signed the log, and the same is being done at all other State capitals through which the unique caravan is passing. Demonstrations are being made at frequent stops along the route. A report of the tour with a complete log will be made at the National Good Roads Show, to be held in Chicago Jan. 15-19, 1923.

Toledo-Chevrolet Plans to Add Three Buildings

TOLEDO, Nov. 1—Contracts for three new buildings involving the expenditure of approximately a half million dollars, including equipment, will be let soon by the Toledo-Chevrolet Co., according to George D. Moore, vice-president and general manager.

One new building will enlarge general machine shop space, an addition will be built to the heat treating department and a heating plant will also be constructed.

The total addition will provide an added 100,000 sq. ft. of manufacturing space and will make possible the equipment for employment of 2500 men in place of the normal 1500 which can now be employed.

The local plant manufactures transmissions and differentials for Chevrolet cars and is the only General Motors unit in this city.

Associated Motor Opens New Executive Offices

DAYTON, Oct. 28—Executive offices of the Associated Motor Industries have been opened here in a three-story building which has been completely remodeled for the purpose. The building is about 250 x 150 feet. The sales department, with spacious display rooms, is on the first floor. Officers of the company occupy offices on the second floor, and departmental offices are located on the third floor.

Milwaukee Reports Month Opening Well

Situation There Better Than in Any November in History of Industry

MILWAUKEE, Oct. 30—The beginning of November will find the automotive industries generally in a greatly improved condition and one that is far more secure than it was on the same day in 1921 or 1920. In fact, reports from all sources lead to the belief that manufacturers regard the immediate situation as far superior to that existing at this season at any time in the history of the industry, especially since the prospect facing it is so substantially sound as it is at present.

Passenger car factories are still being operated at a high rate. In the case of the plants which at no time this year have been running at maximum, the best capacity reached is still being maintained. Others that were producing at their limit have not experienced any cause for material let-down.

The Nash four-cylinder car division in Milwaukee is still running a night shift. It is employing more than 1000 men and turning out about 75 cars a day, which will be increased early in 1923 to an average of 125 cars a day when the extensions now under construction are in full running order. The run of orders for immediate delivery is sufficient to absorb current output easily, while bookings for later shipment already in hand and in prospect insure a heavy run all winter.

Truck Makers Go Ahead

Motor truck builders are making headway slowly but with a greater degree of certainty. Demand for commercial cars from now until spring is expected to enable such factories to make steady increases in production schedules. Motor-bus and other large-capacity passenger vehicle trade likewise is looked upon to furnish an improving winter demand.

Operations are being limited to specifications in current orders and manufacturers of trucks are proceeding conservatively to avoid the pitfall of over-production. It is believed that in case of any sudden and sharp increase in demand, which is a possibility next winter, there is likely to be a material shortage of trucks, which will be more accentuated in bodies, perhaps, than in chassis.

Parts and equipment manufacturers as a rule are running full time and just about keeping abreast of contract specifications and current orders from car manufacturers and the jobbing trade.

FRANKLIN DEALERS INCREASED

SYRACUSE, N. Y., Oct. 30—The number of Franklin dealers has increased 27 per cent during the past year, according to Sales Manager S. E. Ackerman of the Franklin Automobile Co. Fifteen per cent of this increase dates from the first of this year.

Men of the Industry and What They Are Doing

Harry Moock Promoted

Harry Moock has been promoted to sales manager of the Hudson Motor Car Co., taking the position left vacant by H. B. Phipps, who has resumed charge of the foreign fields in which he created a remarkable record before the war. J. S. Draper has been made assistant sales manager. He formerly was district manager in the Middle East. Moock joined the Hudson company about a year ago, entering this organization after resigning the general managership of the National Automobile Dealers' Association, where his energy and acquaintance among the dealers created a nation-wide reputation for him.

Charles B. Wilson Given Dinner

Charles B. Wilson, former vice-president and general manager of the Willys-Overland Co. in Toledo, who resigned two weeks ago to make way for President John N. Willys to take charge of the plant, has gone to Pasadena to visit a brother before returning to his extensive interests in Pontiac, Mich.

Wilson was tendered a dinner by his associates of the plant, the officers of the company, a number of out-of-town visitors and members of the executive committee of the board of directors. He was presented with a watch and chain by the factory officials.

Goodrich Elects Titus

F. E. Titus, who for the past several years has been director of sales of the International B. F. Goodrich Co., has been elected to second vice-president of this company effective Oct. 15. Titus at one time was manager of the Buffalo and Pittsburgh branches. He was later transferred to the foreign sales department with headquarters in New York, and then was brought into Akron to take full charge of the company's foreign sales.

Shepler May Rejoin Overland

The fact that Harry Shepler, formerly vice-president in charge of production at the Willys-Overland Co. in Toledo, arrived in that city this week from California coincident with Willys' return from New York, has lent color to the local talk that Shepler may again be taken into the official Overland family here.

Shepler was one of the most successful factory men ever identified with the Toledo plant.

Goodrich Promotes Underwood

A. G. Underwood, for several years prominently identified with the interests of the B. F. Goodrich Rubber Co. of Akron, has been promoted to the position of manager of sales for Goodrich bicycle tires, Goodrich motorcycle tires and Goodrich automobile rubber sundries. Underwood started in with the Diamond sales organization on the Pacific Coast, was later shifted to the position of branch manager at Milwaukee and just prior to his taking a position with the central organization at Akron, was Goodrich district manager of the Minneapolis territory.

Gamble With Rock Island

William Gamble has been appointed purchasing agent for the Rock Island Plow Co., Rock Island, Ill. For thirty years, he has been a member of the Moline Plow Co. of Moline, Ill., for the past year or two being located at Poughkeepsie, N. Y. He will make his headquarters at Rock Island.

Brennan Sales Manager

B. G. Brennan has been appointed general sales manager of the Inland Products Co. of St. Louis, which has just moved into its new three-story plant.

Brandes Is Erie Export Head

C. O. Brandes has been appointed export manager of the Erie Tire & Rubber Co., Sandusky, Ohio, with an export office at 5511 Euclid Avenue, Cleveland. He has been in the tire business since 1907 and for many years served as export manager for Firestone.

Spooner Resigns as Secretary

F. Ed. Spooner has resigned as secretary of the Old Timers Club. No successor has been appointed.

Leverone Joins Advance Lamp

Nathaniel Leverone has resigned as secretary and treasurer of the Hill Pump Valve Co., Chicago, to become secretary of the Advance Lamp Works of that city. For a number of years Leverone has been a leader in the Automotive Equipment Association.

Atkinson Has Office in South

G. P. Atkinson, for several years connected with the home office sales organization of the Weston Electrical Instrument Co. of Newark, N. J., has opened an office in Atlanta, for the territories of Georgia, South Carolina and northern Alabama. In addition to Weston instruments, Atkinson has several other lines of electrical equipment.

Hopkins Joins Rackliff

Benton Hopkins, formerly advertising manager of Denby Motor Truck Co. and previously associated with other automotive manufacturers in an advertising capacity, has joined the H. L. Rackliff Co., automotive marketing counselors of Cleveland.

Chase to Present Paper

Herbert Chase, Engineering Editor of Automotive Industries, will present a paper on the "Trend of Engineering Development in the Automotive Industry" at a meeting of the Connecticut Section of the American Society of Mechanical Engineers to be held at Mason Laboratory, Yale University, on Nov. 20.

Franz Opens Office

Frederick Franz, for the past four years chief engineer of the Terminal Engineering Co., manufacturer of the TEC truck, has established an engineering office at 27 Warren Street, New York City, for the purpose of solving special problems of engineering relating to labor-saving machinery for industrial plants.

Promotion for J. F. Hartz

J. F. Hartz has resigned as president of the C. M. Hall Lamp Co. of Detroit and Kenosha, an office he held for the last 12 years, and has accepted that of chairman of the Board of Directors. W. F. Anklam, secretary and general manager for the last 12 years, has been elected president and general manager in recognition of the manner in which he has conducted the affairs of the company. The reports submitted to the board by General Manager Anklam showed the affairs of the company to be in a most prosperous condition.

Zahrt Resigns

W. G. Zahrt has resigned as vice-president of the S. F. Bowser & Co., Fort Wayne, Ind.

DeWaters Visits Paris Show

E. A. DeWaters, chief engineer of the Buick Motor Co., was a visitor at the recent automobile show at Paris, France. DeWaters, who is accompanied by Mrs. DeWaters, is making a study of the trend in automobile engineering and design.

Electric Lines Oppose Chicago Bus Extension

CHICAGO, Nov. 1—The application of the Chicago Motorbus Co., under new ownership, for permission to operate additional bus lines on the city boulevards is being vigorously opposed before the Illinois Commerce Commission by representatives of the surface and elevated electric lines, the Illinois Automobile Club and union labor.

The ownership of the bus company, headed by John Hertz, president of the Yellow Cab Manufacturing Co., has pledged to put more than 300 buses in operation at a cost of more than $3,000,000 if permission to use the boulevards is granted.

DEALERS ARE NOT STOCKING CARS

Evidence That Big Production Is Sold

Few Sections Show Disposition Now to Accumulate Open Models

DETROIT, Nov. 1.—No noticeable stocking of cars is reported from the dealers at this time. Sales managers state that while there are soft spots in the country, particularly in the grain zones, there are enough points where business is good to keep a steady flow without an accumulation.

Production schedules, of course, are being pared this month with the exception of Buick and one or two other notable examples. Taking an average of all manufacturers, there is not in excess of one month's supply of cars on the road or in the dealers' hands at the present time. Preparations made some time ago for an increase in the percentage of closed car models has been largely responsible for keeping this situation clear.

As a typical example, Hupp, which will average 18 per cent closed cars for the entire year of 1922, operated on a basis of 35 per cent closed cars for October. Out of 3500 cars manufactured, 1000 were closed. Sales Manager Hutchinson states that he finds no indication of stocking, and in fact that his weekly reports indicate 200 less cars on hand now than a week ago.

None of the companies report anything but a healthy general condition, with not more than the normal number of weak spots, and a very active closed car demand from the metropolitan centers.

New York

NEW YORK, Nov. 1—Late October and early November have brought a decided slowing-up in demand for open cars in the metropolitan territory. Open cars are coming in from the factories, some by freight and some in driveaways, but they are moving much more slowly and in some cases not at all from the establishments of distributors and factory branches. There is beginning a noticeable though not alarming accumulation of open car stock.

San Francisco

SAN FRANCISCO, Nov. 1—San Francisco, Oakland and Berkeley dealers are taking on no more new stocks than necessary to carry orders. There is no special demand in northern and central California for open cars.

Boston

BOSTON, Nov. 1—Some of the larger Boston distributors are now planning to arrange with their banking interests to stock cars for spring delivery. They will be both open and closed models. They are getting orders for spring delivery now as an indication that after the motor show in March there will be a big demand for cars, and they have faith in the future, when elections, strikes and other unsettled conditions have been swept away.

Indianapolis

INDIANAPOLIS, Nov. 1—There has been no appreciable stocking or storage of open or closed cars to date. The large storage house leased to the dealers' association is practically empty. Sales are still brisk in many lines. Two weeks ago there was a sharp drop in some lines. A shortage is noted in closed types with several dealers. Selling is keeping pace with deliveries. Sales are generally above average.

Kansas City

KANSAS CITY, Nov. 1—No decided general tendency is noted to stock cars here, but there is a decided recognition of the probability that farmers will be able to buy this winter and that they are most likely to buy open models. They are not sold on closed cars chiefly because of supposed unfeasibility on rough

(*Continued on page* 907)

244,000 *CARS AND TRUCKS MADE IN OCTOBER; TOTAL FOR* 10 *MONTHS IS* 2,119,227

NEW YORK, Nov. 1—Basing the estimate on the shipping returns, the National Automobile Chamber of Commerce announces the approximate production of cars and trucks for the month of October to be slightly in excess of 244,000, which is the best October on record, and the seventh consecutive month this year that production has exceeded 200,000. Total output for the ten months of this year is estimated at 2,119,227.

	Output	Carloads			Driveaways			Boat		
	1922	1920	1921	1922	1920	1921	1922	1920	1921	1922
January	91,109	20,057	6,485	15,357	29,283	3,185	7,479	....	93	143
February	122,366	25,505	9,986	19,636	43,719	7,507	10,173	....	99	180
March	172,720	29,236	16,287	27,753	57,273	9,939	16,917	....	75	560
April	219,558	17,147	20,187	31,334	64,634	14,197	22,381	....	1,619	2,960
May	256,219	21,977	18,608	33,416	74,286	15,193	28,827	....	2,381	7,406
June	289,011	22,516	20,269	34,230	60,746	18,834	33,857	8,350	3,947	7,737
July	245,414	23,082	19,514	28,412	52,342	15,533	28,022	8,702	3,726	6,855
August	273,425	23,386	20,350	32,563	34,060	14,290	36,603	7,095	3,565	10,028
September	205,405	20,804	20,150	25,950	24,431	13,550	30,005	5,469	3,580	3,002
October	244,000	17,209	17,323	....	14,127	11,257	33,320	2,519	2,300	7,404

Factory shipments for the other months of 1920 and 1921 follow:

	Carloads		Driveaways		Boat	
	1920	1921	1920	1921	1920	1921
November	13,253	14,061	9,497	10,509	659	1,385
December	11,802	12,100	6,469	7,500	89	134

Demand for Closed Cars Is Keeping Up Schedules

(*Continued from page* 894)

crease in sales is expected to follow the improvement of the general international situation. Ford is increasing the output in its foreign plants and general business conditions have had a stimulating effect on sales.

Parts makers report collections better than a year ago, with business for September showing an increase of 62.1 per cent over the same month last year, but with car manufacturers purchasing more conservatively than during the earlier months of the season.

It is probable that tire manufacturers will begin shortly to build up reserve stocks to take care of the spring demand. Finished inventories now are low and will require considerable working up before next year to prevent a shortage.

Trucks are showing a steady advance, with sales for the popular makes in industrial sections of the country running as high as 100 per cent over 1921.

JOHN B. FOOTE DIES

CHICAGO, Oct. 30—John Bergoyne Foote, president and treasurer of Foote Bros. Gear & Machine Co. is dead. He was a pioneer in making cut-steel, case hardened, tough cored gears for heavy duty work.

September Exports Kept Up to August

Passenger Cars Shipped Aggregated 5,862; Trucks, 1,295, and Motorcycles, 1,360

WASHINGTON, Oct. 30—Development of the overseas sales of automotive equipment continued during the month of September, as is shown by the export figures for that month, made public to-day by the Automotive Division of the Bureau of Foreign and Domestic Commerce. Shipments were practically at the same high level as in August, the September totals being 5862 passenger cars, 1295 motor trucks, parts (except engines and tires) to the value of $3,226,764 and 1360 motorcycles. The detailed statements of the shipments are given elsewhere on this page.

The figures announced by the Division pertain only to the United States and do not include the comparatively heavy export shipments from the various plants, principally of Ford and General Motors, located in Canada. For some time Canadian shipments have averaged approximately 2500 cars a month, and reports from various sources indicate that the September distribution from there was going ahead on a normal level.

Review for Three-Quarters

With the September business from the United States, it is possible to review the American export trade for the first three-quarters of the year. Here the same tendencies are shown as in the domestic market. Starting with January, sales abroad have picked up as sales conditions became better, and the result has been that 48,328 motor cars were sold in the foreign market during the nine months' period, an average of nearly 5500 per month.

The truck shipments for the nine months have totaled 8080. The adjoining table shows the classifications into which these shipments fall, both as to passenger cars and motor trucks. Parts shipments for the three-quarters period have attained the surprising total of $128,410,260. In every case the total is far above that of 1921 and compares very favorably with sales during the same period of 1919, in some cases being higher this year. These nine months' figures do not include shipments from Canada.

Export Table of Products of the Automotive Industry Shipped from the United States for September, 1922, and for the Nine Months That Preceded

	Month of September				Nine Months Ending September			
	1921		1922		1921		1922	
	No.	Value	No.	Value	No.	Value	No.	Value
Automobiles, including chassis	2,669	$2,352,434	7,161	$5,142,653	29,845	$35,093,235	56,601	$43,329,558
Electric trucks and passenger cars	....	....	4	6,938	....	....	193	283,723
Motor trucks and buses, except electric	472	481,664	....	....	5,945	8,714,623	....	....
Up to 1 ton	....	....	977	366,121	....	....	5,674	2,268,978
Over 1 and up to 2½ ton	....	....	282	270,893	....	....	1,858	2,296,417
Over 2½ ton	....	....	36	126,805	....	....	548	1,448,305
Total motor trucks and buses, except electric	472	481,664	1,295	763,819	5,945	8,714,623	8,080	6,013,700
PASSENGER CARS								
Passenger cars, except electric	2,197	1,870,770	....	....	23,900	26,378,612	....	....
Value up to $800	....	....	3,852	1,889,239	....	....	30,986	14,946,738
Value over $800 and up to $2,000	....	....	1,857	2,063,754	....	....	15,818	17,525,748
Value over $2,000	....	....	153	418,903	....	....	1,524	4,559,649
Total passenger cars, except electric	2,197	1,870,770	5,862	4,371,896	23,900	26,378,612	48,328	37,032,135
PARTS, ETC.								
Parts, except engines and tires	....	2,570,860	*14,548,700	3,226,764	....	31,126,453	*119,414,004	28,410,260
Station and warehouse motor trucks	12	11,195	7	7,253	299	229,385	123	126,125
Trailers	....	....	85	24,960	....	....	387	164,525
Airplanes and seaplanes	8	31,000	....	....	43	271,940	32	58,130
Parts of airplanes, except engines and tires	....	3,956	*62,220	16,862	....	132,534	*193,016	76,066
BICYCLES, ETC.								
Bicycles and tricycles	....	48,342	1,158	10,679	....	1,353,234	7,228	96,463
Motorcycles	584	151,165	1,360	321,731	9,197	3,011,071	11,804	3,068,780
PARTS, EXCEPT TIRES								
Gas engines	124	17,305	294	50,536	898	268,357	3,671	517,685
Traction engines (steam) except agricultural	2	7,218	3	4,245	67	105,558	28	55,076
Automobile engines	899	133,229	1,194	205,378	6,937	1,390,148	37,521	4,215,477
Aircraft engines	....	....	3	900	....	....	101	63,617
Complete tractors, except agricultural	43	22,261	3	3,475	5,135	5,634,065	37	103,855
Other internal combustion engines	540	71,100	208	49,390	6,700	1,418,122	3,421	569,481

*Pounds.

ASH BUSINESS IMPROVED

ATLANTA, Nov. 1—According to Atlanta mill operators producing ash at their various plants in the southeastern territory, this business from the automobile manufacturers has been the best the past two months of any time this year and gives promise of holding up well all winter.

The big demand is for the thicker grades of ash, and practically all of the important sales are to the automobile trade. Dimensions in best demand are 10/4, 12/4 and 16/4, with prices slightly upward. Nearly all ash mills over the district that are at capacity supply the automobile trades.

ON EL AUTOMOVIL STAFF

NEW YORK, Oct. 31—Edgar P. Day, who for a number of years has represented the *American Exporter* and previous to that the *Horseless Age*, has joined the advertising staff of *El Automovil Americano*, the Spanish automotive dealer paper published by The Class Journal Co., and will make his headquarters in Detroit.

RECEPTION GIVEN OFFICIALS

ELGIN, ILL., Oct. 28—A reception attended by about 500 persons was given by citizens of Elgin last night to officials of the American Steam Truck Co., manufacturer of the American Steamer passenger car, in celebration of the location of the company's factory here. The American company has taken over the plant of the Duty truck company

Wisconsin City May Have Motor Vehicle Warehouse

MILWAUKEE, Oct. 30—Plans for the organization of a bonded warehousing corporation that will be responsible for the storing of more than $1,000,000 worth of motor vehicles during the winter months are under consideration by the automotive division of the Association of Commerce of Green Bay, Wis. The dealers of Green Bay and vicinity again are confronted by the problem of adequate and controllable warehouse space for new car stocks during the slack selling season from the end of November to the end of March, when the most severe weather usually comes.

It is planned to lease the main exposition building of the Brown County Fair Grounds as a warehouse. Practically all dealers would become stockholders in the bonded warehousing corporation, which would provide proper guards, insurance and other requirements. At present there is no bonded warehouse nearer than Milwaukee.

Supplies Low When Mexico Levied Duty

Results of Impost of 10 Per Cent Awaited—Demand for American Makes

MONTEREY, MEXICO, Oct. 27—What effect the placing of a 10 per cent ad valorem duty upon all imported automobiles may have upon the sale of cars in this country remains to be seen. The new duty was fixed by decree of President Alvaro Obregon and came unexpectedly to dealers, many of whom found themselves with depleted stocks.

During the last several months there has been quite a revival in the demand for automobiles of American manufacture, especially for the medium price cars. Dealers made many sales and this kept their stocks low. The 10 per cent ad valorem duty which must now be paid on all cars will be added to the retail sale price, it is stated.

Use of Cars Expanding

Until recently the sale and use of automobiles in Mexico were confined almost entirely to the larger cities, particularly Mexico City, Monterey, Chihuahua, Guadalajara, Tampico, Torreon and a few others. This was due to two reasons—one, the danger which one met with of being held up by brigands in the smaller communities and rural districts and, second, the lack of passable highways. Travel overland, however, is now considered to be safer than at any time since the overthrow of President Porfirio Diaz, nearly twelve years ago.

The Obregon Government is giving much attention to the construction and improvement of public roads. The program for such improvements is extensive, but the lack of money is hampering its fulfillment. Much has been done during the last twelve months in the matter of improving the streets and suburban roads of Mexico City, and this has stimulated the sale of automobiles in the capital.

Good Roads Developed

It is now possible to take automobile journeys of considerable distance out of Mexico City over paved or hard-surfaced highways. Such resorts as Cuernavaca, Chapala, Orizaba, as well as towns which are situated in the Federal District, are now easily reached over good roads. In Monterey the contract was let recently for paving many streets, at a total cost of $1,500,000 United States money. When the revolutionary period began the streets of Guadalajara, the second largest city of Mexico, had just been paved and were in perfect condition. Long neglect has caused many of these former perfectly paved streets to be badly in need of repair. Steps to place them in good condition have been taken, and with the finishing of the work it is expected the demand for automobiles there will show a material increase. In Tampico the large American colony created and kept up a good demand for automobiles all through the long series of revolutionary disturbances.

There has been a general expansion of automobile trade facilities in this country during the last several months. Practically every make of automobile in the United States is now represented in the larger cities. Many new garages and accessory houses have been established.

FILE CREDIT DATA, URGED ON EXPORTER

WASHINGTON, Nov. 1—American automobile exporters should arrange with their American banks to have copies of credit reports on themselves sent to their bank's foreign correspondents, is the advice that is being given by the Bureau of Foreign and Domestic Commerce.

After filing such reports, care should be exercised by the reporter to make sure that financial reports on his standing actually are on file in the foreign banks before customers are referred to these institutions for credit information.

Appleton Will Resume Making Reliance Truck

APPLETON, WIS., Oct. 30—The Appleton Motor Truck Co., which recently was incorporated with $50,000 capital, has for its purpose the taking over of the plant and business of the defunct Reliance Motor Truck Co. of Appleton, manufacturing the Reliance truck, Badger truck axles and other truck parts. The Reliance company was forced into bankruptcy by lack of working capital early this year. At receiver's sale the entire property was acquired by a group of old and new capital, who have incorporated the new company.

The officers are: President, A. G. Brusequitz; vice-president, John Heenan; secretary, William Geenen; treasurer, Matt Rossmeissl; directors, Harry Leppla, W. J. Jamison, Frank Tremel and W. P. Tremel.

In addition to resuming the production of Reliance trucks, axles, etc., the new concern plans to manufacture power farm implements and will start with a check-row potato planter. No heavy manufacturing program is planned for the winter months, but next spring an intensive schedule will be instituted. In the meantime service will be given Reliance owners and a campaign made for general automotive repairs.

WILLIAM D. UHLER DIES

HARRISBURG, Oct. 30—William D. Uhler, chief engineer of the Pennsylvania State Highway Department, is dead, following a brief illness. Col. Uhler was one of the country's leading good roads advocates.

Exports Benefited By New Rail Rates

Reduction Made by Western Roads on Consignments for Pacific Shipment

NEW YORK, Oct. 30—Better rates from middle western points to Pacific Coast ports when consignments are destined for China, Japan, Manila, India, Australia and New Zealand have been allowed through the efforts of the traffic committee of the National Automobile Chamber of Commerce. Eastern lines also are being urged to make a different rate arrangement for exports to Europe and other foreign destinations.

J. S. Marvin, N. A. C. C. traffic manager says that manufacturers are quite willing to concede a higher minimum weight on their shipments if the railroads will grant a correspondingly lower rate. The boxing of motor vehicles makes heavier loading possible, but the railroads have been charging the same rate as for domestic shipments.

The new export rates for shipping via the west coast are as follows:

Automobiles, passenger, K.D., and parts thereof, boxed: New rate, $2.50 per 100 lbs.; minimum weight, 16,000 lbs; old rate, $3.65 per 100 lbs.; minimum weight, 10,000 lbs.

Automobile parts (exclusive of bodies) boxed: New rate, $1.75 per 100 lbs.; minimum weight, 30,000 lbs.; old rate, $2.73 per 100 lbs.; minimum weight, 30,000 lbs.

The foregoing new rates also apply from New York piers of the Southern Pacific and Mallory lines and from the Philadelphia piers of the Southern Steamship Co.

Government Will Film Continental Engine

WASHINGTON, Oct. 30—Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, announces that the Continental Motors Corp. of Detroit will co-operate with the Department of Commerce in the production of a motion picture film covering the complete mechanical functions of an internal combustion engine. This work will be under the direction of G. W. Yeoman, vice-president of Continental, cooperating with M. F. Leopold, the government motion picture engineer.

Government officials state that the Automotive Library consists now of educational films embracing representation of six-cylinder motor cars of two distinct types and an eight-cylinder "V" type motor car, which, in conjunction with this new film, will permit the government to promote American automotive interests effectively in every country of the world. More than 400 requests have been received from various foreign countries for these films to be shown in universities and educational institutions, motor trade associations, etc.

Rubay Will Market Line of Town Cars

Follows European Model in Design—Chassis Adapted to American Conditions

CLEVELAND, Nov. 1—The Rubay Co. is preparing to introduce a line of small town cars to bear the name Leon Rubay. They are intended especially for city use and are said to follow closely the design of cars used for similar purposes in Europe. The chassis is a French design, but adapted to American conditions by American engineers.

The chassis has a 118 in. wheelbase intended to facilitate maneuvering in traffic, a small four cylinder, 2¾ x 5¼ in. high speed engine, said to be capable of developing 36 hp. at 3000 r.p.m., single plate clutch running in oil, conventional gearset mounted as a unit with engine, full floating axle with stamped steel housing, four-wheel brakes operated by steel ribbons and an aluminum dash.

Rubay Designed Bodies

Only closed bodies of Rubay design and construction will be used. These will include a four-passenger coupé, six-passenger sedan, berlin, cabriolet and brougham.

The engine is a clean design, has cylinders with ⅞ in. offset, separate head with integral manifolds, overhead valves and camshaft driven by helical bevel gears and a concealed water pump. Air supply for the Stromberg carburetor is drawn over the exhaust pipe and through the cylinder block. This passage communicates with the crankcase so that a slight vacuum in the latter tends to prevent oil leakage.

The cylinder barrels extend well into the case, and the cylinders are attached with internal studs so that no external connections appear. Lubrication is full force feed through hollow crankshaft and camshaft. The crankshaft of chrome nickel steel is carried on three main bearings. Connecting rods are of forged Lynite, pistons are cast Lynite, with three concentric rings.

Vacuum Tank in Recess

A vacuum tank is carried in a recess in the aluminum dash. Bosch electric units are employed. Starter and generator are supported beside the gearset, the generator having chain drive with eccentric mounting for adjustment.

Brake drums are of aluminum with steel linings for the expanding, Thermoid-covered aluminum shoes to bear against. Drive and torque are taken by a torque tube. The differential carrier is attached to the rear cover plate. The axle gears give a 5.1 to 1 reduction. Both front and rear wheels are carried on Timken bearings. They are of wood and have Firestone rims.

The front axle is forged from chrome nickel steel. The shafts for operating the front wheel brakes are carried in the channel forming the rear part, the I-section, the cams being in the lower part of the drums. Both sets of brakes are pedal operated, the rear set being also hand operated.

Springs are low and normally flat. A special spring mounting is used, both front and rear. The front end of the front spring is attached to the frame by the conventional eye and bolt. The rear end of the spring is flat and is carried between two hardened rollers mounted in a cast steel spring bracket. The same type of mounting is used for the front end of the rear spring.

It is planned that the new cars will be exhibited for the first time at the New York Salon in December.

Studebaker Adds Coupe to Line of Big Sixes

SOUTH BEND, Nov. 1—The Studebaker Big Six line has been increased by the addition of a 5-passenger coupe which includes such features as nickel plated front and rear bumpers, automatic windshield wiper, rear view morror, Moto-Meter and ornamental radiator cap. The coupe has a two-door body and upholstery is in dark brown velour. Equipment includes heaters, transmission lock, cowl ventilator, automatic windshield regulators, two-piece rain-vision windshield, eight-day clock, and a trunk in the rear.

New Dort Six Followed Along Lines of "Four"

FLINT, MICH., Nov. 1—The new six-cylinder model Dort follows fundamentally the lines of the four. The wheel base is longer, being 115 in. The engine is a Falls model T-8000 with modifications incorporated by the chief engineer of the Dort Motor Car Co. The outstanding features are a built-in pressure feed oiling system and use of silcrome valves.

The drive is similar in construction to the four cylinder model. Wheels are all 31 x 4 with cord tire equipment. Six body styles are offered.

NEW APPERSON SIX

KOKOMO, IND., Nov. 1—The new smaller Apperson six, which will make its appearance during the winter, will list between $1,200 and $1,400, the definite price not having been determined. It will have 122 or 124 in. wheelbase, and the engine will be high powered.

STARTER MAKER ENJOINED

CHICAGO, Nov. 1—In a suit brought by the Connecticut Telephone & Electric Co. of Meriden, Conn., the United States District Court has granted an injunction against the Illinois Starter & Magneto Corp., restraining it from "selling, advertising or offering for sale parts intended as replacements" on Connecticut igniters. This covers breaker plates, breaker arms and springs therefor. The decree was issued by Judge Carpenter.

Coal Is Responsible for Greater Output

October Production Meets Demand That September Could Not Take Care of

NEW YORK, Nov. 1—Analyzing the report of the traffic committee, which showed an October production of approximately 244,000, directors of the National Automobile Chamber of Commerce at their monthly meeting to-day decided that the increase was brought about by the increased availability of coal, which was relatively scarce in September. The production in October meets a number of unfilled orders, as well as supplying October sales, which were about 25 per cent under September in most sections of the country. The fall months, though seasonally fewer than the summer, are expected to register the best autumn trade on record.

It was reported that the demand for cars is keeping up despite the season of the year, and that cars are moving at such a rate that dealers have not begun to think of stocking up. It will be another month, at least, before they will begin accumulating a surplus of stock, it is thought.

Activity Explained

This continued activity is explained in several ways. In the first place the continued demand for closed cars has kept up the market, the industry as a whole averaging 32 per cent production on closed cars, a growth of at least 10 per cent in the last year. This has been made possible by increased capacity of the body plants. Another explanation is that prospects who had been waiting for lower prices have come into the market because they are convinced that the manufacturers have met their demands for lower lists. Undoubtedly, too, the Ford reduction has been a great incentive to buying.

The truck business, it was reported, shows surprising strength, and the prospects never were better. Buyers are anticipating a shortage of railroad transportation and purchasing trucks accordingly, while the betterment of general business has been another contributing factor to the prosperity of the truck makers. Shortage in freight transportation is maintaining the truck market at the September level, with Massachusetts, Texas, Pennsylvania and Ohio showing increases.

COL. CLIFTON DECORATED

BUFFALO, Nov. 1—Col. Charles Clifton, head of the Pierce-Arrow Co. and president of the National Automobile Chamber of Commerce, has been decorated by France with the order of the Legion of Honor for services to France during the war. The formal ceremony took place at a dinner at the Buffalo Club.

Stutz Stockholders Approve Bond Issue

Also Authorize Increasing Capital Stock of Company by 63,000 Shares

NEW YORK, Nov. 1—Stockholders of the Stutz Motor Car Co. of America have authorized the issue of $1,500,000 15 year 7½ per cent convertible sinking fund debentures, of which the company intends soon to issue $1,000,000. Approval was given also to an increase of the authorized capital stock by 63,000 shares, making the total 263,000.

Of the additional stock authorized, 33,000 shares will be set aside to provide for conversion of the bonds, and the remainder will be offered to stockholders at $20 a share in the proportion of 3 new shares for 20 shares of old stock held. The bonds, which will be convertible into stock on the basis of 33 shares for each $1,000 par value, will also be offered to stockholders for pro-rata subscription.

Both the bond and stock issues have been underwritten. Proceeds will be used to develop and improve the property.

General Tire Expects Doubling of Business

AKRON, Oct. 30—The General Tire & Rubber Co. has announced plans for three new three-story factory buildings which will be installed with new equipment so as practically to double the company's present tire capacity of 2500 tires daily.

"We now are behind on October deliveries and expect to sell twice as many tires next year as this year," announced Vice-President William O'Neil. "The company has just completed a conference of all field representatives and branch managers at which it told them to prepare to handle twice as much general business in 1923 as they are doing this year."

Service Heads Prepare Program for Convention

NEW YORK, Nov. 1—Preparations for the convention of factory service managers of members of the National Automobile Chamber of Commerce, in Chicago, on Nov. 14 and 15, have practically been completed. The sessions will be held in the La Salle Hotel.

Tuesday morning Thomas J. Hays, president of the Chicago Automobile Dealers' Association, will make the address of welcome, and the scheduled talk for the first day will be made by H. J. Leonard, vice-president of the Stephens Motor Car Co. The remainder of the day will be devoted to discussion of selected topics.

On Wednesday the subject to be considered will be automotive service associations, their relations and benefits to the factory, dealer and car owner. One speaker will be selected to talk from each viewpoint. B. B. Bachman, chief engineer of the Autocar Co. and president of the Society of Automotive Engineers, will speak from the viewpoint of the manufacturer.

Aero Club Can Continue Arrangements for Merger

NEW YORK, Nov. 1—Decision against Henry Woodhouse has been made by Superior Court Justice McCook in two actions involving the Aero Club of America. Action brought by the club resulted in a temporary court injunction restraining Woodhouse from representing himself as an officer of the club and from sending mail to members and others as "Chairman of the Administrative Committee."

The court directed Woodhouse to cancel an order given to the Post Office Department concerning club mail and ordered him to return to the club files of papers which he admits taking.

Justice McCook denied Woodhouse's plea for an injunction restraining the present management of the Aero Club from continuing plans to merge the club with the National Aeronautic Association.

Woodhouse has brought action for reinstatement to determine whether he is still a member of the club and has any standing in court.

ENRICHT CONVICTED

NEW YORK, Nov. 1—Louis Enricht, the 76-year-old resident of Farmingdale, L. I., who claimed to have invented a process of making cheap gasoline from peat, has been convicted of larceny by a Long Island court on complaint of a Jamaica garage owner who had invested $3,000 in the Enricht Peat Corp. and who claimed Enricht made false representations. According to a representative of the United States Patent Office, no patent ever had been issued for the making of gasoline from peat, and it was also declared the method which Enricht claimed was impracticable.

TORBENSEN PROTECTED

NEW YORK, Nov. 1—The Torbensen Axle Co. of Cleveland has obtained a perpetual injunction in the United States District Court of New York, restraining the United Gear Manufacturers Corp. of New York City from using the Torbensen name in selling parts for the Torbensen axle when those individual parts are not made by the Torbensen company.

HENDEE ELECTS OFFICERS

SPRINGFIELD, MASS., Nov. 1—At the annual meeting of the Hendee Manufacturing Co. here, these officers were elected: President, Henry H. Skinner; vice-president, William E. Gilbert; vice-president and general manager, Frank J. Weschler; secretary, Parmly Hanford. Lindsley Hopkins, banker, Atlanta, was made a new member of the board of directors, the rest of the board being re-elected.

Relief from Rubber Restriction Sought

Association Cables to London—Committee Headed by Hotchkiss Is Named

(*Continued from page* 895)

ard production the actual output of each producer during the 12 months—Nov. 1, 1919, to Oct. 31, 1920—amplified in accordance with certain rules adopted. In lieu of existing export duties, a minimum export duty is to be levied on that percentage of standard production which is allowed to be exported under the plan at the minimum rate of duty, the committee recommending that this minimum be fixed at the lowest possible rate, not to exceed one penny per pound.

If a producer desires to export a quantity greater than that allowed to be exported at the minimum rate of duty he will be called upon to pay an export duty on his total export during the period of 12 months, ranging from 4 to 12 pence per pound. The percentage exportable at the minimum rate is 60.

Akron Non-Committal

AKRON, Oct. 30—Although Akron tire manufacturers admit that the steadily rising quotations on rubber and cotton make an increase in tire prices a logical consequence, few, if any, will commit themselves as to the probabilities of their companies boosting prices in the immediate future.

At least one of the larger companies in the Akron district, however, is known to have new price schedules, showing a substantial increase, ready for announcement Nov. 15. Officials of other companies say their present policy is to stand pat on present prices as long as possible and until spring, if it can be managed. The company planning to increase prices is one of those which undercut all competitors during the tire price slashing war of a few months ago, and which placed its standard tires in perhaps the lowest price level.

Watchful Waiting Policy

However, the situation in Akron, based upon past experience, cannot be properly analyzed no matter what the manufacturers say. The history of the tire industry shows that they may say they plan no increases in prices and the next minute boost them 10 or 20 per cent. Smaller companies usually pursue a watchful waiting policy, letting the larger concerns take the first steps toward price readjustment.

It is confidentially believed though, despite this uncertainty of action, that manufacturers will be forced, by the upward trend of rubber and cotton costs, to revamp their price schedules during the ensuing month, and men close to the industry say they would not be surprised to see price increases announced before Dec. 1.

FINANCIAL NOTES

Allan-Diffenbaugh Wrench & Tool Co., Baraboo, Wis., will increase its capitalization in order to handle the larger volume of business offered it, which the existing facilities are inadequate to accommodate. Offers have been received from a number of other cities for the relocation of the industry, and this will be done if local capital does not take sufficient interest in the new stock issue to enable the concern to finance its development.

Reynolds Spring Co. reports that in the quarter ended Sept. 30 it earned from its spring business alone $133,000, after depreciation but before taxes. After allowing for three months' proportion of preferred dividends, the company shows a balance of $188,839, or $1.61 a share on 73,500 shares of common, a rate of $6.44 a year. Earnings on the common for the first six months were at the annual rate of $3 a share.

Yellow Cab Manufacturing Co. reports a profit of $819,626 for the three months ending Sept. 30 after provisions for taxes and employes' profit sharing. Net for the nine months was at a rate of approximately $13.75 on 200,000 shares class B outstanding after the class A dividend. Working hours have been lengthened one hour. Cab factory and general plant capacity have been increased 50 per cent.

Hood Rubber Products Co. reports sales approximating $18,100,000 for the first nine months of 1922, as compared with $17,218,416 for the corresponding period of 1921. Of this, sales of tires were about 25 per cent in value. Bank loans as of Sept. 30 were $2,442,000, compared with $3,585,000 on March 31. It is expected these will be reduced to about $1,000,000 by March 31, 1923.

Hayes Wheel Co. has declared a dividend of 75 cents a share, payable Dec. 15 to stock of record Nov. 30. Heretofore the company has been paying dividends at the rate of 50 cents a share quarterly. The business of the company has been satisfactory and indications point toward net earnings well over $6 a share before Federal taxes.

Goodyear Tire & Rubber Co. of Canada has resumed regular quarterly dividends of 1¾ per cent on the preferred stock and 1½ per cent on the prior preferred stock together with accrued dividends on the latter, cumulative since Jan. 1, 1922. Payment will be made Jan. 10 to stock of record Dec. 31.

Edward G. Budd Manufacturing Co. stockholders will meet Dec. 20 to approve an increase in the capital to $14,498,000. Capitalization now is $8,750,000. The new stock is to be preferred. The concern is a manufacturer of pressed steel bodies and the Budd Wheel Co. is affiliated with it.

Campbell, Wyant & Cannon Foundry Co., Muskegon, has sold to the Continental and Commercial Trust & Savings bank of Chicago, a bond issue, $850,000 of 6½s. The funds will be used to take up present outstanding bonds, also to erect a large addition to the company's plant.

Gray & Davis, Inc., has declared an initial quarterly dividend of $2 per share on the new preferred stock, payable Nov. 1 to stock of record Oct. 27.

THREE NEW SALON EXHIBITORS

NEW YORK, Nov. 1—De Dion Bouton and Voisin of France and the Hispano-Suiza of Spain have been added to the list of exhibitors in the Automobile Salon to be held at the Hotel Commodore, this city, Dec. 3-9, and at the Hotel Drake, in Chicago, Jan. 27 to Feb. 3. This will mark the debut of the Voisin in this country and the return of De Dion Bouton, which has been out of the American market for six years.

John H. Stelling, formerly sales manager of the De Dion Bouton selling branch in New York, has become importer of both the DeDion and the Voisin, while Hispano-Suiza has formed an American connection with the Hispano-Suiza Motors, Inc., of which A. B. Caragol is president and Alfred E. Manning, sales director.

Seaman Body to Duplicate Present Milwaukee Plant

MILWAUKEE, Oct. 30—Issuance of a building permit reveals that the addition for which ground has been broken by the Seaman Body Corp., Milwaukee, will exactly duplicate the original factory erected about two years ago. The new building will be 225 x 425 ft., five stories and basement and the cost, without equipment, is given as $300,000. The original structure cost in excess of $500,000.

The Seaman company, formerly the W. S. Seaman Co., is a pioneer manufacturer of closed bodies and is now producing also open bodies. Charles W. Nash is a large stockholder. The additional facilities are required by the increased demands for bodies by the Nash six works at Kenosha, the Nash four works in Milwaukee, and the LaFayette plant, now being erected adjacent to the Nash four works and scheduled to be completed about Dec. 1 or Jan. 1, when the LaFayette operation will be transferred in its entirety from Indianapolis to Milwaukee.

Deficit of Pierce-Arrow Is Less Than Last Year

BUFFALO, Nov. 1—Pierce-Arrow Motor Car Co. reports an operating income of $11,209 for the three months ending Sept. 30. Interest, taxes and other charges were $351,178, which left a deficit of $339,969 as against a deficit of $2,109,999 in the same period last year.

Deficit for the nine months ending Sept. 30, 1922, amounted to $376,961, while in the same period of last year a deficit of $4,000,051 was reported.

RHODE ADDRESSES S. A. E.

BOSTON, Oct. 27—O. J. Rhode, general manager of the Wire Wheel Corp. of Detroit, was the speaker at the fall meeting of the New England section of the S. A. E., held to-night at the Engineers Club. He gave an account of the development of motor car wheels, tracing their history from the wood to the wire and disc types, and predicted wire and disc wheels would gradually supersede the wood.

His talk was illustrated by lantern slides which showed the process of making both disc and wire wheels. A general discussion followed the address.

BANK CREDITS

Written exclusively for AUTOMOTIVE INDUSTRIES *by the Guaranty Trust Co., second largest bank in America.*

Last week rates for call loans ranged between 4 per cent and 6 per cent, as compared with 4½ per cent to 6 per cent in the preceding week. For fixed date maturities little change was noted, and trading continued without special features. Quotations remained the same as in the previous week, 4¾ per cent for 60 days' maturities, 4¾ to 5 per cent for 90 days, 4, 5 and 6 months. The prime commercial paper rate continued to be quoted at 4¼ per cent to 4½ per cent.

The volume of business for the week ending Oct. 26, as indicated by bank clearings in the leading cities of the United States, totaled $7,689,381,000, which was a loss of 13.7 per cent from the preceding week, but a gain of 28.3 per cent over the corresponding week last year.

Revenue freight car loadings for the week ending October 14 were 983,470, a gain of 1.6 per cent over the amount loaded in the preceding week, 8 per cent over the corresponding week of 1921, but 3.4 per cent less than for the corresponding week in 1920, which year marked the peak total in the history of car loadings. The biggest increase shown during the week of October 14 was in coal, 7614 more cars having been loaded.

Soft coal production for the week of Oct. 21 totaled 10,200,000 tons. This was the first time since the week of April 1, just before the strike, that soft coal output has passed the 10,000,000-ton mark.

In sharp contrast to the relatively small total for the month of August, new capital flotations for September were far in excess of any September total in recent years. New issues to the amount of $565,824,897 were brought out in September, as compared with $199,211,136 in August, $381,609,071 in July and $422,093,857 in September, 1921. Two issues which were important factors in swelling the numbers for September were the offerings of new stock of the American Telephone & Telegraph Co. to the amount of $115,000,000 and the Federal Land Bank Farm Bonds to the amount of $75,000,000.

The Federal Reserve statement as of Oct. 25, 1922, showed a decrease of $1,730,000 in gold reserves and $2,279,000 in total reserves. Bills on hand declined to $40,824,000 and total earning assets $79,089,000. Deposits showed a decrease of $114,337,000, and Federal Reserve notes in circulation declined $16,901,000.

BUICK'S BEST MONTH

DETROIT, Nov. 1—October was the best month in the history of the Buick Motor Co., production reaching 17,666. September was the best previous month with 16,482. Shipping records were made during the month as follows: Oct. 12, 775; Oct. 25, 910; Oct. 26, 973; and Oct. 30, 1029.

Dealers State Cars Not Being Stocked

Shows That Big Production Is Being Consumed—Northwest Slightly Behind

(*Continued from page* 901)

country roads and also because of the farmer's tendency to buy transportation for needs as low priced as possible and yet have quality equipment.

St. Louis

ST. LOUIS, Nov. 1—Several dealers have stored open cars within the past few weeks due to a slump in sales recently. Very few have any larger number of closed cars on hand. Most dealers are behind on closed car deliveries, this being especially true on new models recently announced.

Cleveland

CLEVELAND, Nov. 1—Motor car dealers here are not stocking open cars. They are carrying on an extensive campaign for the sale of closed cars and are doing well.

Buffalo

BUFFALO, Nov. 2—Buffalo dealers are stocking cars, including open models, moderately. They are not filling warehouses with them as in former years, but are taking reasonable precautions against being caught short when next year's business opens up. The foregoing applies to dealers handling makes of cars most in demand.

Philadelphia

PHILADELPHIA, Nov. 1 — Inquiry shows that big distributors and dealers are not stocking up on open models. They are sold up and the question is one of deliveries. The tendency is to order more closed models than open ones.

Milwaukee

MILWAUKEE, Nov. 1 — Milwaukee dealers say that there is nothing unusual in the manner of stocking cars nor the quantity on hand. They are proceeding as usual at this season.

Minneapolis

MINNEAPOLIS, Nov. 1—Dealers of the Northwest are stocking cars because they find the prospects are not flush with money to buy. Grain is moving slowly owing to the railroad and boat situation. Elevators are full of grain waiting to move.

DURANT EMPLOYS 26,876

NEW YORK, Oct. 30—Durant activities, that is those concerns directly identified with the big corporation and with companies manufacturing parts for it, now employ 26,876 persons in all their plants, which are spread through 25 cities Of this total 13,876 are working on materials, 2500 in sales and distribution and 7500 in sales and service. It is believed that this total will be doubled by February, 1923, and that if present schedules are carried out there will be 100,000 by June, 1923.

INDUSTRIAL NOTES

Decker - Mitchell Engineering Co. of Cleveland, which was organized last summer to manufacture special production machinery and tools, has taken over the plant and equipment formerly owned by the Cleveland Precision Tool Co. In addition to its regular line it is turning out hardened and ground parts and screw machine products for the motor car trade. The company is making extensive plans for expansion to take care of increased volume of business in the manufacture of piston pins, hardened and ground bushings, and front axle king pins. It is maintaining a designing and engineering department, for the design of special tools and fixtures for its customers.

American Turn Auto Corp., recently incorporated in Delaware, has moved its plant from Iowa to Bucyrus, where it will continue the manufacture of a device for the turning over of automobiles to enable workmen to get underneath for repairs and overhauling. The distributing company has located at 40 East Gay Street, Columbus, with H. M. Bennett as president and general manager.

Hayes Wheel Co. of Canada, Ltd., is equipping the factory of General Forgings & Stampings, Ltd., at Meriton, which was purchased recently for the production of outside automobile rims. The metal stamping equipment will be transferred to the forging company's plant at Chatham, but the forge plant at Meriton will not be disturbed.

Cadillac Printing Co. has taken over the Verschoor Service for the production of technical catalogs, parts lists, instruction books, etc. R. A. Leavell, for several years connected with the Verschoor Service, remains as manager of the department. C. A. Verschoor, founder of the business, is retaining an interest in the company.

Presto-O-Lite Co., Inc. has announced the removal of its main office from New York to Indianapolis. This action is taken in order to bring sales, service and production into close relation at the most central point of distribution east of the Rocky Mountains.

WILLYS DIVIDEND

TOLEDO, Nov. 1—The Federal Court here will be asked to grant authority to-morrow for distribution of a 40 per cent dividend on the approved claims of creditors of the Willys Corp. Distribution will amount to approximately $6,400,000 and will be made Saturday, according to the present plans. Receivers have in Toledo banks $5,000,000 and have received from the New Jersey district $1,750,000 and from the southern district of New York about $400,000. Out of a total of $18,000,000 of claims, approximately $16,000,000 have been approved to date.

METAL MARKETS

From day to day the markets for pig iron and steel products are shedding more and more of what artificiality still adheres to them as an heirloom of the recent bulge in prices. Pig iron prices are as vulnerable as they were two years ago when, following a short-lived $50 market, decline followed decline until three months later $35 was chalked up and in another three months $25 had become the market's average. In the present movement pig iron prices did not soar to the absurd levels of two years ago and the decline will be proportionately less incisive. Moreover, the coal and transportation difficulties furnished a more substantial basis for the recent flurry than was the case two years ago.

At the same time, the fact remains that in a rising pig iron market there is always lacking that element of restraint which makes for a greater measure of stability in the steel market. When those on the selling side of market, in a period when they have things practically their own way, permit values to climb to abnormal heights, they have no cause for complaint when the market turns against them and buyers fail to give it any support until a condition bordering on demoralization has set in. The declines so far registered fail to attract pig iron consumers who are waiting for much lower levels before they will commit themselves for more than immediate requirements. In the steel market premiums on rush deliveries have vanished and consumers, no matter how urgent their wants may be, experience no difficulty in finding producers ready to accommodate them.

Of some interest to automotive steel consumers just now is the hoary conundrum of whether the egg came before the hen or vice versa, only that the problem which confronts them is whether the sheet bar market makes the sheet market or the sheet market that for sheet bars. Representative tonnages of sheets bars have recently been sold to sheet rollers. In some of these sales prices lower than $40 a ton prevailed. Some say that the considerably easier tone of the sheet market which has been in evidence for about a fortnight was directly responsible for the recession in sheet bar prices. Others contend that the reason for the more moderate price views of rollers is to be sought in the turn in the sheet bar market in the latters' favor during the last fortnight. Undoubtedly considerable of the heavy tonnage of sheet bars recently taken on by rollers will go into sheets booked at lower prices than those in vogue at the culmination of the recent upward movement.

After all the why of the easier conditions in the sheet bar and sheet markets matters little. The all important fact is that they are easier. It may be said that the $3 average differential per ton in the quotations of the chief interest and those of the independents has become nominal, so far as first quarter 1923 business is concerned.

Pig Iron. — Demand from automotive foundries is more or less of retail proportions and chiefly for malleable. Representative buying is in abeyance until prices have become more settled.

Aluminum.—Market conditions are entirely unaltered. Sheets continue in light supply. Odd lots of imported metal are absorbed at prices very close to those of the domestic producer.

Copper.—The market continues weak and domestic consumers show no interest at all.

Calendar

SHOWS

Nov. 13-18 — Chicago, Annual Show and Meeting of the Automotive Equipment Association.

Dec. 3-9—New York, Eighteenth Annual Automobile Salon, Commodore Hotel.

Jan. 6-13—New York, National Automobile Show, Grand Central Palace, under auspices of National Automobile Chamber of Commerce.

Jan. 8 - 13 — New York, Second National Automobile Body Builders Show, Twelfth Regiment Armory, under the auspices of the Automobile Body Builders Association.

Jan. 27-Feb. 3—Chicago, Annual Automobile Salon.

Jan. 27 - Feb. 3 — Chicago, National Automobile Show, under auspices of National Automobile Chamber of Commerce, Coliseum and First Regiment Armory.

FOREIGN SHOWS

Nov. 3 - 11 — London (Olympia), Automobile Show.

Nov. 9 - 19 — Buenos Aires, Argentina, Annual Exhibition. Automovil Club Argentino.

Nov. 29-Dec. 4—London (Olympia), Cycle and Motorcycle Show. British Cycle Motors, The Tower, Warwick Road, Coventry.

Dec. 15 - Jan. 2 — Paris, Aeronautical Salon, Grand Palace. Chambre Syndicale des Industries Aeronautiques, 9 Rue Anatole de la Forge.

Jan. 13-24 — Brussels, Sixteenth International Automobile and Cycle Exposition, Palais du Conquantenaire.

May - July, 1923 — Gothenburg, Sweden, International Automobile Exhibition, Sponsored by the Royal Automobile Club of Sweden.

CONVENTIONS

Oct. 26-28—Washington, Second National Conference for the Study of Highway Engineering and Highway Transport Education.

Nov. 14 - 15 — Chicago, Semi-Annual Convention, Factory Service Managers, National Automobile Chamber of Commerce, La Salle Hotel.

Jan. 15-19—Chicago, Thirteenth American Good Roads Congress and Fourteenth National Good Roads Show.

Jan. 29 - 31 — Chicago, Annual Meeting, Automobile Electric Association, Congress Hotel.

S. A. E. MEETINGS

Metropolitan Section

Nov. 16 — Speaker, A. L. McNurty, Consulting Engineer, Connecticut State Motor Vehicle Commission; Subject, Regulations Governing the Use of Rural Highways.

Dec. 14 — Speaker, Charles P. Grimes, Research Engineer, H. H. Franklin Manufacturing Co.; Subject, Air Cooling in Automotive Engines.

March 15—Speaker, William P. Kennedy, President, Kennedy Engineering Corp.; Subject, Trolley Buses and Flexible Vehicles for Street Railway Service.

April 19—Speaker, Edw. E. La Schum, General Superintendent, Motor Vehicle Equipment, American Railway Express Co.; Subject, Engineering Features of Fleet Operation.

May 17—Speaker, F. P. Gilligan, Secretary, Henry Souther Engineering Co., Subject, Metallic Materials for Automotive Work.

Other Meetings

Jan. 9 - 12 — New York, Annual Meeting.

Jan. 31 — Chicago Meeting and Dinner of the Society at the Congress Hotel.

Shuler Axle Reorganized with Ample Cash Sources

LOUISVILLE, Oct. 30—The reorganization of the Shuler Axle Co. has been completed. The refinancing has been accomplished, it is announced, and ample cash resources are said to be available to insure the development of the company.

The personnel of the company has been rounded out by the appointment of W. E. Dugan as vice-president and general manager, and the re-appointment of F. A. Shuler as director of engineering and manufacturing. Previous to accepting the appointment as a Shuler executive, Dugan was manager of the Cincinnati axle plant of the Standard Parts Co. During his 18 years' experience in the industry, he has served also as factory manager for the U. S. Motor Truck Co. and for the Selden Motor Vehicle Co.

The Shuler factory is rapidly being placed in full production on a complete line of front axles for motor coaches, trucks, tractors and trailers. A feature of the lines is the Shuler wheel brakes, a mechanism permitting simultaneous braking on all four wheels. Patents on this device were granted during the past summer.

Osaka, Japan, Decides to Start Bus Service

LOS ANGELES, Nov. 1—Information received by motor truck manufacturers here from Osaka, Japan, carries details of the decision of the municipal authorities of that city to inaugurate a system of bus transportation, commencing with twenty buses and later expanding to possibly fifty. The announcement is considered especially significant in view of the remarkable progress being made in swinging Japan away from antiquated methods of transportation.

The bodies of the Osaka city buses will be of the single-deck type, seating 16 passengers, with a permanent roof. Some form of collapsible side-curtains with celluloid windows will probably be used instead of the usual rigid frame construction with glass windows. The chassis will be some standard 1½-2 ton type, mounted on pneumatic tires and with full electric equipment.

The inadequacy of the present railway system in Osaka, as in other cities in Japan, has led the municipal assembly to seek some means of relieving the traffic congestion which is growing worse from year to year. Normally 650,000 persons a day are carried on the present railway lines, and when there is any particular attraction in the city, the number of passengers carried often exceeds 1,000,000.

Present plans call for the inauguration of the service on April 1, 1923.

Commercial Vehicles Show Improvement in Columbus

COLUMBUS, Nov. 1—There has been a marked improvement in the demand for trucks and commercial vehicles of all kinds in Columbus during the past few weeks. Dealers in trucks are united in saying that there is a considerable improvement in business conditions generally and that inquiries for all types of trucks are much more numerous. Another feature is the fact that those making the inquiries are generally bonafide prospects and that sales are more frequent than they were formerly.

While business is running largely to the lighter style of vehicles such as delivery types, still there is a good increase in the demand for the heavy trucks. This is apparent with the dealers of the three- and five-ton varieties. Haulage companies are now increasing their equipment while wholesale grocers, commission men and building supply people are also buying heavy trucks. The tone of the trade is good and dealers anticipate a sustained demand during the early part of the winter, at least.

Hill Wins 100 Mile Race on Speedway at Berkeley

BERKELEY, CAL., Oct. 30—Bennett Hill and his Miller-motored racer won the 100 mile race here Sunday in 52 min., 38.4 sec., an average of 114½ m.p.h. Frank Elliott was second, a quarter of a mile behind the winner. Jimmy Murphy won third from Harry Hartz by an eyelash.

Hill took the lead at the start and was never headed, driving through without a pit stop and coming in on ragged tires rather than risk losing the race to Elliott by stopping to change them.

This was the last race of the season on this track, the next event on the coast schedule being the Thanksgiving Day races at Los Angeles. To-day's races were preceded by motorcycle sprint races.

The results of the motorcycle races follow:—10 mile, won by Ralph Hepburn; Jim Davis, second, Ray Weishaar, third; time, 5 min., 42 sec. Twenty miles, won by Ray Weishaar; T. Terry, second; A. R. Sarkesian, third; time, 11 min., 48 sec.

AUTO-LITE EXPANDING

FOSTORIA, OHIO, Nov. 1—Addition to the local plant of the Electric Auto-Lite Co. is under way. A large three-story brick building, formerly used by the Allen Motor Co., is being rebuilt on the interior. The second floor of this building will be used for the offices. The heavier machinery of the company will be installed on the first floor. At least four departments will be added when the building is ready.

ANOTHER GASOLINE CUT

CHICAGO, Oct. 31—Another cent was taken from the price of gasoline to-day by the Standard Oil Co. of Indiana. The service station price in Chicago is now 20 cents a gallon, and the tank wagon price is 18 cents.